



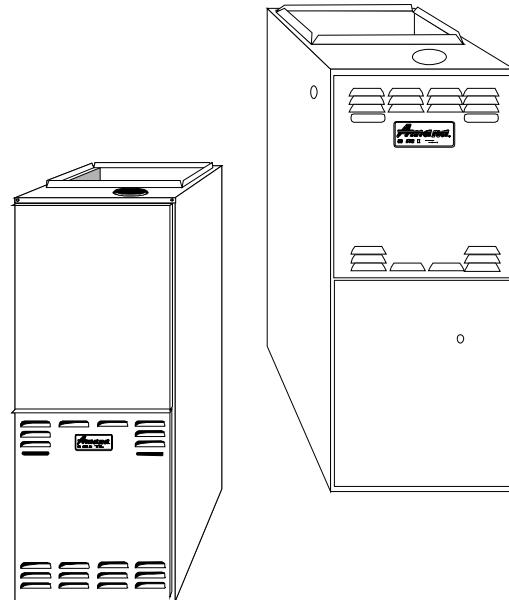
# GUIS/GCIS

## Two-Stage Gas-Fired Warm Air Furnace Installation Instructions

Affix this manual, Specification Sheet and Users Information Manual adjacent to the furnace.

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Amana Forced Air Central Furnace Design Complies With Requirements Embodied in The American National Standard / National Standard of Canada Shown Below.

ANSI Z21.47•CSA-2.3 Central Furnaces



RECOGNIZE THIS SYMBOL AS A SAFETY PRECAUTION.

### ATTENTION INSTALLING PERSONNEL

As a professional installer you have an obligation to know the product better than the customer. This includes all safety precautions and related items.

Prior to actual installation, thoroughly familiarize yourself with this Instruction Manual. Pay special attention to all safety warnings. Often during installation or repair it is possible to place yourself in a position which is more hazardous than when the unit is in operation.

Remember, it is your responsibility to install the product safely and to know it well enough to be able to instruct a customer in its safe use.

Safety is a matter of common sense...a matter of thinking before acting. Most dealers have a list of specific good safety practices...follow them.

The precautions listed in this Installation Manual are intended as supplemental to existing practices. However, if there is a direct conflict between existing practices and the content of this manual, the precautions listed here take precedence.



## WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- What to do if you smell gas:
  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.



## WARNING

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the furnace before shutting off the electrical supply.

### To The Owner

It is important that you fill out the owner's registration card and mail it today. This will assist us in contacting you should any service or warranty information change in the future. When filling in the registration card, be sure to include the Model, Manufacturing and Serial Numbers, plus the installation date.

Your warranty certificate is also supplied with the unit. Read the warranty carefully and note what is covered. Keep the warranty certificate in a safe place, so you can find it, if necessary.

If additional operating instructions are required, call the dealer where the purchase was made.

### To The Installer

Before installing this unit, read this manual to familiarize yourself on the specific items which must be adhered to, such as maximum external static pressure to unit, air temperature rise, minimum or maximum CFM, motor speed connections, and venting. These furnaces are designed for Category I venting only.



## WARNING

To prevent possible death or personal injury due to asphyxiation, Amana Non-Condensing Gas Fired Warm Air Furnaces must be Category I vented. Do not vent any of these furnaces using Category III venting.

*Keep this literature in a safe place for future reference.*

### I. Safety and Unit Location



## WARNING

To prevent personal injury or death due to improper installation, adjustment, alteration, service, or, maintenance refer to this manual or for additional assistance or information consult a qualified installer, service agency or the gas supplier.



## WARNING

This product contains or produces a chemical or chemicals which may cause serious illness or death and which are known to the State of California to cause cancer, birth defects or other reproductive harm.



## WARNING

To prevent possible death, personal injury or equipment damage due to fire, the following points must be observed when installing the unit.



## WARNING

To prevent possible death, personal injury or property damage due to electrical shock, the furnace must be located to protect the electrical components from water.

**NOTE:** This unit must not be used as a "construction heater" during the finishing phases of construction on a new structure. This type of use may result in premature failure of the unit due to extremely low return air temperatures and exposure to corrosive or very dirty atmospheres.



## WARNING

**To prevent possible death, personal injury or property damage, do not install this unit in a mobile home, trailer or recreational vehicle.**

### ADDITIONAL SAFETY CONSIDERATIONS

- This furnace is approved for Category I Venting only.
- When the furnace is heating, the temperature of the return air entering the furnace must be between 55°F and 100°F.
- Furnaces installed in areas frequently contaminated by
  - permanent wave solutions
  - chlorinated waxes or cleaners
  - chlorine based swimming pool chemicals
  - water softening chemicals
  - deicing salts or chemicals
  - carbon tetrachloride
  - halogen type refrigerants
  - cleaning solutions (such as perchloroethylene)
  - printing inks
  - paint removers
  - varnishes
  - hydrochloric acid
  - cements and glues
  - antistatic fabric softeners for clothes dryers or
  - masonry acid washing materials

must be sealed to prevent contaminated air from reaching the furnace. The furnace must still have an adequate supply of combustion air, either from a nearby uncontaminated room or from outdoors. For details, see "AIR REQUIREMENTS" Section III.

- Provisions must be made for venting combustion products outdoors through a proper venting system. The length of flue pipe could be a limiting factor in locating the furnace.
- When installed horizontally, the furnace must be installed with the access doors vertical so that the burners fire horizontally into the heat exchanger. The unit cannot be installed with the access doors on top or bottom. (See Specification Sheet)
- Allow clearances from the enclosure as shown on Specification sheet for fire protection, proper operation, and service access. These clearances must be permanently maintained. The combustion and ventilating air openings in the front and top panels of the furnace must never be obstructed.
- This furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.
- When the furnace is used in connection with a cooling unit, the furnace must be upstream of, or in parallel with, the cooling unit. For details see Section VII.
- On Counterflow Installations, the air conditioning coil must be downstream from the heat exchanger of the furnace.
- *Counterflow Installation over a noncombustible floor.* Before setting the furnace over the plenum opening, ensure the surface around the opening is smooth and

level. A tight seal should be made between the furnace base and floor by using a silicone rubber caulking compound or cement grout.

- *Counterflow Installation over a combustible floor.* If installation over a combustible floor becomes necessary, use an accessory subbase as shown on the Specification Sheet. Follow the instructions with the subbase for proper installation. Do not install the furnace directly on carpeting, tile, or other combustible material other than wood flooring. (Note: The subbase will not be required if an air conditioning coil is installed between the supply air opening on the furnace and the floor.)
- The furnace must be level. If the furnace is to be set on a floor that may become wet or damp at times, the furnace should be supported above the floor on a concrete base sized approximately 1-1/2" larger than the base of the furnace.

### ADDITIONAL LOCATION CONSIDERATIONS

- Centralize the furnace as is practical with respect to the air distribution system.
- Do not install the furnace directly on carpeting, tile, or combustible material other than wood flooring.
- When suspending the furnace from rafters or joists, use 3/8" threaded rod and 2" x 2" x 3/8" angle as shown on the Specification Sheet. The length of the rod will depend on the application and clearance necessary.
- If installed in a residential garage, the furnace must be positioned so that the burners and ignition source are located at minimum 18 inches (457 mm) above the floor and protected from physical damage by vehicles.

## II. General Information



## WARNING

**Possible death, personal injury or property damage due to fire, explosion, smoke, soot, condensation, electrical shock or carbon monoxide may result from improper installation, repair, operation, or maintenance on this product.**

To ensure the furnace operates safely and efficiently, it must be installed, operated and maintained in accordance with these installation and operating instructions, all local building codes and ordinances, or, in their absence, with the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1\*, and/or CAN/CSA B149 Installation Codes.

The rated heating capacity of the furnace should be greater than or equal to the total heat loss of the area to be heated. The total heat loss should be calculated by an approved method or in accordance with "ASHRAE Guide" or "Manual J-Load Calculations" published by the Air Conditioning Contractors of America.

\*Obtain from: American National Standards Institute, 1430 Broadway New York, NY 10018.

## TRANSPORTATION DAMAGE

Check the furnace for any shipping damage. If damage is found, contact the company where the furnace was purchased.

While checking for transportation damage, remove all packaging material and dispose or recycle according to local codes.

## THERMOSTAT REQUIREMENTS

The two stage furnace requires a two stage thermostat for proper operation. A two stage thermostat will have a "W2" terminal in addition to a "W1" terminal. Refer to Section VI for proper hookup.

## THERMOSTAT LOCATION

Locate the thermostat about 5 feet high on a vibration-free inside wall, in an area having good air circulation

Do not install the thermostat where it may be affected by:

- drafts or dead spots behind door, in corners or under cabinets.
- hot or cold air from ducts.
- radiant heat from sun or appliances.
- concealed pipes and chimneys.
- unheated (uncooled) areas behind the thermostat, such as an outside wall.

Consult the instructions packaged with the thermostat for mounting instructions.

## III. Combustion and Ventilation Air Requirements



### WARNING

**Possible death, personal injury or property damage may occur if the furnace and other fuel-burning appliances are not provided with enough fresh air for proper combustion and ventilation of flue gases. Most homes require outside air to be supplied into the furnace area.**

Improved construction and additional insulation in buildings has reduced the heat loss, making these buildings much tighter around doors and windows so air infiltration is minimal. This creates a problem supplying combustion and ventilation air for gas fired and other fuel burning appliances. Use of appliances pulling air out of the house (clothes dryers, exhaust fans, fireplaces, etc.) increases this problem causing appliances to starve for air.

*This furnace must use indoor air for combustion. It cannot be installed as a direct vent (i.e., sealed combustion) furnace. The burner box is present only to help reduce sound transmission from the burners to the occupied space.*

## AIR REQUIREMENTS

Most homes will require outside air be supplied to the furnace area by means of ventilation grilles or ducts connecting directly to the outdoors or spaces open to the outdoors such as attics or crawl spaces.

The following information on air for combustion and ventilation is reproduced from the **National Fuel Gas Code NFPA 54/ANSI Z223.1 Section 5.3.**

### 5.3.1 General:

- The provisions of 5.3 apply to gas utilization equipment installed in buildings and which require air for combustion, ventilation and dilution of flue gases from within the building. They do not apply to (1) direct vent equipment which is constructed and installed so that all air combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere, or (2) enclosed furnaces which incorporate an integral total enclosure and use only outside air for combustion and dilution of flue gases.
- Equipment shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas, proper venting and the maintenance of ambient temperature at safe limits under normal conditions of use. Equipment shall be located so as not to interfere with proper circulation of air. When normal infiltration does not provide the necessary air, outside air shall be introduced.
- In addition to air needed for combustion, process air shall be provided as required for: cooling of equipment or material, controlling dew point, heating, drying, oxidation or dilution, safety exhaust, odor control, and air for compressors.
- In addition to air needed for combustion, air shall be supplied for ventilation, including all air required for comfort and proper working conditions for personnel.
- While all forms of building construction cannot be covered in detail, air for combustion, ventilation and dilution of flue gases for gas utilization equipment vented by natural draft normally may be obtained by application of one of the methods covered in 5.3.3 and 5.3.4.
- Air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements.

### 5.3.2 Equipment Located in Unconfined Spaces:

In unconfined spaces (see definition below) in buildings, infiltration may be adequate to provide air for combustion ventilation and dilution of flue gases. However, in buildings of tight construction (for example, weather stripping, heavily insulated, caulked, vapor barrier, etc.) additional air may need to be provided using the methods described in 5.3.3-b or 5.3.4.

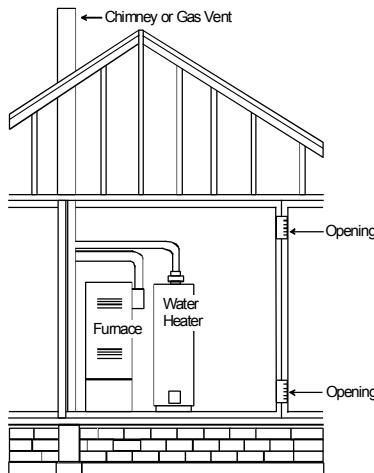
**Space, Unconfined.** For purposes of this Code, a space whose volume is not less than 50 cubic feet per 1,000 BTU per hour of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, are considered a part of the unconfined space.

### 5.3.3 Equipment Located in Confined Spaces:

- All Air from Inside the Building:** The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment

installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of 1 square inch per 1,000 BTU per hour of the total input rating of all gas utilization equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure (Figure 1).

**NOTE:** Each opening must have a free area of not less than one square inch per 1000 BTU of the total input rating of all equipment in the enclosure, but not less than 100 square inches.

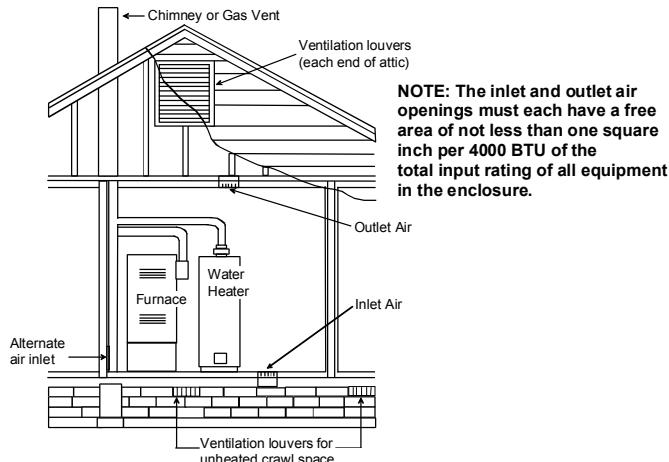


**Figure 1**

### Equipment Located in Confined Spaces; All Air from Inside Building. See 5.3.3-a

(b) *All Air from Outdoors:* The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

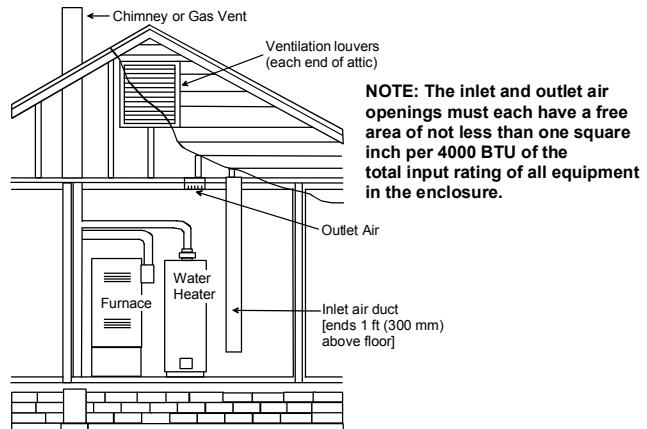
1. When directly communicating with the outdoors, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure (Figure 2).



**Figure 2**

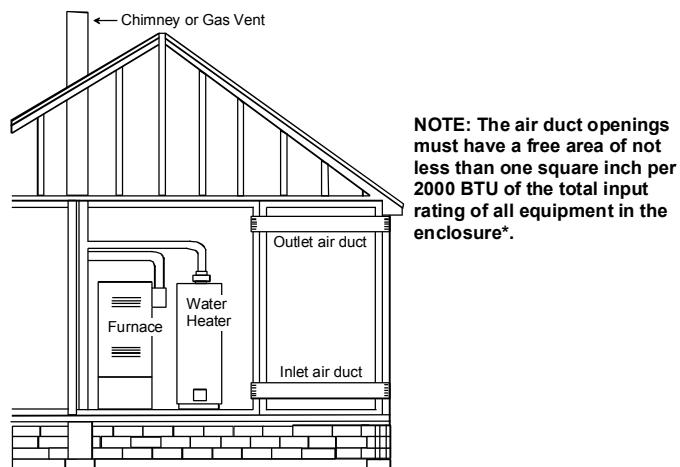
### Equipment Located in Confined Spaces; All Air from Outdoors—Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic. See 5.3.3-b

2. When communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure (Figure 3).



**Figure 3**  
Equipment Located in Confined Spaces; All Air from Outdoors Through Ventilated Attic. See 5.3.3-b.

3. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 BTU per hour of total input rating of all equipment in the enclosure (Figure 4).

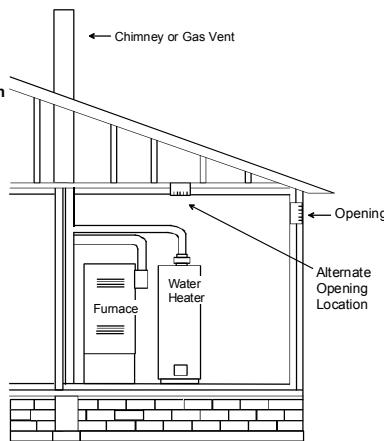


\*If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than one square inch per 4,000 BTU per hour of the total input rating of all appliances in the enclosure.

**Figure 4**  
Equipment Located in Confined Spaces; All Air from Outdoors. See 5.3.3-b.

4. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall not be less than 3 inches.

NOTE: The single opening must have a free area of not less than one square inch per 3000 BTU of the total input rating of all equipment in the enclosure, but not less than the sum of the areas of all vent connectors in the confined space.



**Figure 5**  
**Equipment Located in Confined Spaces; All Air from Outdoors - Single Air Opening. See 5.3.3-b.**

- When directly communicating with the outdoors, the single opening shall have a minimum free area of 1 square inch per 3,000 BTU per hour of total input rating of all equipment in the enclosure

#### 5.3.4 Specially Engineered Installations:

The requirements of 5.3.3 shall not necessarily govern when special engineering, approved by the authority having jurisdiction, provides an adequate supply of air for combustion, ventilation, and dilution of flue gases.

#### 5.3.5 Louvers and Grilles:

In calculating free area in 5.3.3, consideration shall be given to the blocking effect of louvers, grilles or screens protecting openings. Screens used shall not be smaller than 1/4 inch mesh. If the area through a design of louver or grille is known, it should be used in calculating the size of opening required to provide the free area specified. If the design and free area is not known, it may be assumed that wood louvers will have 20-25 percent free area and metal louvers and grilles will have 60-75 percent free area. Louvers and grilles shall be fixed in the open position or interlocked with the equipment so that they are opened automatically during equipment operation.

#### 5.3.6 Special Conditions Created by Mechanical Exhausting or Fireplaces:

Operation of exhaust fans, ventilation systems, clothes dryers, or fireplaces may create conditions requiring special attention to avoid unsatisfactory operation of installed gas utilization equipment.

Category I Venting is venting at a non-positive pressure. A furnace vented as Category I is considered a fan-assisted appliance and does not have to be "gas tight." **NOTE:** Two stage gas furnaces with induced draft blowers draw products of combustion through a heat exchanger allowing in some instances common venting with natural draft appliances (i.e. water heaters).

All installations must be vented in accordance with National Fuel Gas Code NFPA 54/ANSI Z223.1 - latest edition. In Canada, the furnaces must be vented in accordance with the National Standard of Canada, CAN/CSA B149 - latest additions and amendments.

**NOTE:** The vertical height of the Category I venting system will be at least as great as the horizontal length of the venting system.



#### WARNING

**To prevent possible death or personal injury due to asphyxiation, common venting with other manufacturer's induced draft appliances is not allowed.**

The minimum vent diameter for the Category I venting system is as shown below:

MINIMUM VENT DIAMETER		
MODEL	GUIS	GCIS
70	4 Inch	4 Inch
90	4 Inch	4 Inch
115	5 Inch	N/A
140	5 Inch	N/A

Under some conditions, larger vents than those shown above may be required or allowed.

*When an existing furnace is removed from a venting system serving other appliances, the venting system may be too large to properly vent the remaining attached appliances.*

The following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- Seal any unused openings in the common venting system.
- Visually inspect the venting system for proper size and horizontal pitch as required in the National Fuel Gas Code NFPA 54/ANSI Z223.1, or the CAN/CSA B149 Installation Codes and these instructions. Determine there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
- Where practical, close all building doors, windows, and all doors between the space where the appliances remain connected to the common venting system are located and other spaces of the building. Turn on all gas appliances not connected to the common venting system and operate on high speed all exhaust fans (range hoods and bathroom), except summer exhaust fans. Close fireplace dampers.

## IV. Category I Venting (Vertical Venting)



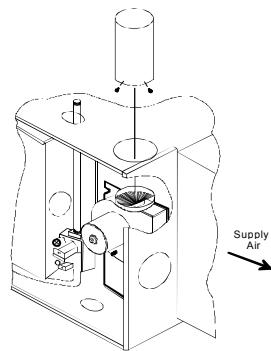
#### WARNING

**To prevent possible death or personal injury due to asphyxiation, Amana Non-Condensing Gas Fired Warm Air Furnaces must be Category I vented. Do not vent any of these furnaces using Category III venting.**

- (d) Following the lighting instructions, place the furnace being inspected in operation. Adjust thermostat so appliance will operate continuously.
- (e) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation; use the flame of a match or candle.
- (f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
- (g) If improper venting is observed during any of the above tests, the common venting system must be corrected in accordance with the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1.

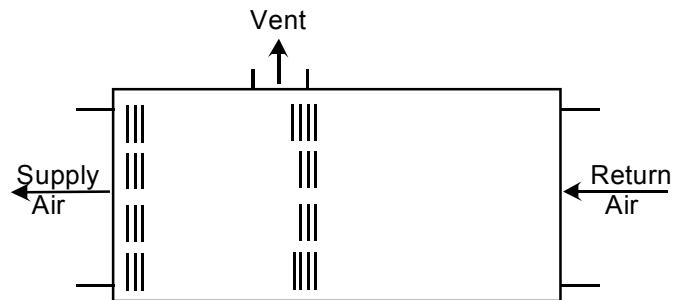
When resizing any portion of the common venting system, use the appropriate table in Appendix G in the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1.

**Upflow or Horizontal units** are shipped with the induced draft blower discharging from the top of the furnace. ("Top" is as viewed for an upflow installation.) The induced draft blower can be rotated 90 degrees counterclockwise for Category I venting, with the airflow horizontal left to right (Figure 5). For horizontal installations, a four inch single wall pipe can be used to extend the induced draft blower outlet 1/2" beyond the furnace cabinet. Vent the furnace in accordance with the National Fuel Gas Code NFPA 54/ANSI Z223.1 - latest edition. In Canada, vent the furnace in accordance with the National Standard of Canada, CAN/CSA B149 - latest editions and amendments.



**Figure 5**  
**Upflow Rotated Induced Draft Blower**

**Counterflow units** are shipped with the induced draft blower discharging from the top of the furnace. ("Top" is as viewed for a counterflow installation.) The induced draft blower can be rotated 90 degrees counterclockwise for Category I venting, with the indoor airflow horizontal right to left (Figure 6). For horizontal venting, a three inch B-vent pipe can be used to extend the induced draft blower outlet 1/2" beyond the furnace cabinet. Vent the furnace in accordance with the National Fuel Gas Code NFPA 54/ANSI Z223.1 - latest edition. In Canada, vent the furnace in accordance with the National Standard of Canada, CAN/CSA B149 - latest editions and amendments.



**Figure 6**  
**Counterflow Rotated Induced Draft Blower**

To rotate the induced draft blower counterclockwise proceed as follows:

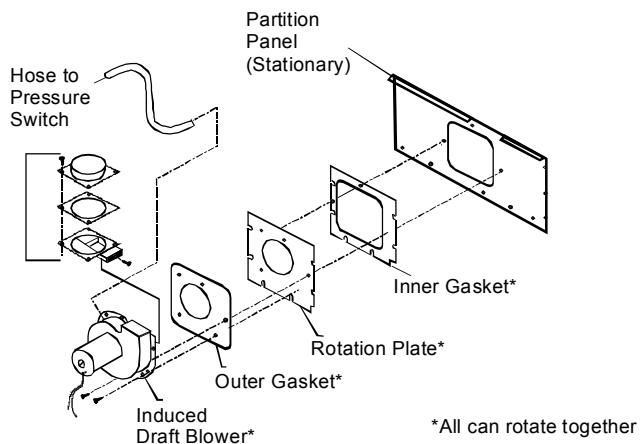
1. Disconnect electrical power from furnace.

**WARNING**

To prevent death or personal injury due to electrical shock, disconnect electrical power.

2. Remove the round cutout from the side of the furnace.

**Note:** The assembly, starting from the outside, is induced draft blower, outer gasket, rotation plate, inner gasket, partition panel (Figure 7).



**Figure 7**  
**Blower Assembly**

3. Remove and save the four screws which hold the rotation plate on the partition panel. Note that one of the screws which hold the induced draft blower on the rotation plate needs to be removed.
4. Turn the rotation plate 90 degrees counterclockwise. The inner gasket must turn with the rotation plate.
5. Reinstall the rotation plate on the partition panel, using the four screws removed in step 3. Tighten all screws to provide an airtight seal.
6. Make sure all wires are at least one inch from flue pipe. Relocate junction box to right side of cabinet if necessary. Refer to Section VI, Electrical Wiring for instructions.



## WARNING

To prevent death or serious illness to building occupants due to flue products leaking into the building, proper installation of gaskets and screws is essential for providing a gas tight seal between the partition panel and the induced draft blower.

## V. Gas Supply and Piping

### GENERAL

The furnace rating plate includes the approved furnace gas input rating and gas types. The furnace must be equipped to operate on the type of gas applied. This includes any conversion kits required for alternate fuel and/or high altitude.



## CAUTION

To prevent unreliable operation or equipment damage, the inlet gas supply pressure must be as specified on the unit rating plate with all other household gas fired appliances operating.

Inlet gas supply pressures must be maintained within the ranges specified below. The supply pressure must be constant and available with all other household gas fired appliances operating. The minimum gas supply pressure must be maintained to prevent unreliable ignition. The maximum must not be exceeded to prevent unit overfiring.

Inlet Gas Pressure	
Natural	Min. 5.0" W.C., Max. 10.0" W.C.
Propane	Min. 11.0" W.C., Max. 13.0" W.C.

*Inlet gas pressure must not exceed the maximum value shown in table above.*

**NOTE:** Adjusting the minimum supply pressure below the limits in the above table could lead to unreliable ignition.

Gas input to the burners must not exceed the rated input shown on the rating plate. Overfiring of the furnace could result in premature heat exchanger failure. Gas pressures in excess of 13 inches water column could result in permanent damage to the gas valve.

At all altitudes, the manifold pressure must be within 0.3 inches WC of that listed on the "Specification Sheet" for the fuel used. At all altitudes and with either fuel, the air temperature rise must be within the range listed on the furnace nameplate.

### High Altitude Derate

When this furnace is installed at high altitude, the appropriate High Altitude orifice kit must be applied. This is required due to the natural reduction in the density of both the gas fuel and combustion air as altitude increases. The kit will provide the proper design certified input rate within the specified altitude range.

High altitude kits are purchased according to the installation altitude and usage of either natural or propane gas. Refer to the product Specification Sheet or an Amana distributor for a tabular listing of appropriate altitude ranges and corresponding manufacturer's high altitude (Natural, Propane Gas, and/or Pressure Switch) kits.

Do not derate the furnace by adjusting the manifold pressure to a lower pressure than specified on the furnace rating plate. The combination of the lower air density and a lower manifold pressure will prohibit the burner orifice from drawing the proper amount of air into the burner. This may cause incomplete combustion, flashback, and possible yellow tipping.

In some areas the gas supplier may artificially derate the gas in an effort to compensate for the effects of altitude. If the gas is artificially derated, the appropriate orifice size must be determined based upon the BTU/ft<sup>3</sup> content of the derated gas and the altitude. Refer to the National Fuel Gas Code, NFPA 54/ANSI Z223.1, and information provided by the gas supplier to determine the proper orifice size.

A different pressure switch may be required at high altitude regardless of the BTU/ft<sup>3</sup> content of the fuel used. Refer to the product Specification Sheet or an Amana distributor for a tabular listing of appropriate altitude ranges and corresponding manufacturer's pressure switch kits.

### Propane Gas Conversion



## WARNING

Possible death, personal injury or property damage may occur if the correct conversion kits are not installed. The appropriate kits must be applied to ensure safe and proper furnace operation. All conversions must be performed by a qualified installer or service agency.

This unit is configured for natural gas. The appropriate manufacturer's propane gas conversion kit, must be applied for propane gas installations. Propane gas installations require an orifice change to compensate for the energy content difference between natural and propane gas.

Refer to the product Specification Sheet or contact an Amana distributor for a tabular listing of appropriate manufacturer's kits for propane gas and/or high altitude installations. The indicated kits must be used to ensure safe and proper furnace operation. All conversions must be performed by a qualified installer, or service agency.

## GAS PIPING CONNECTIONS

### General



### CAUTION

To avoid possible unsatisfactory operation or equipment damage due to underfiring of equipment, use the proper size of natural/propane gas piping needed when running pipe from the meter/tank to the furnace.

When sizing a trunk line, be sure to include all appliances which may be operated simultaneously.

The gas pipe supplying the furnace must be properly sized based on gas flow required, specific gravity of the gas and length of the run. The gas line installation must comply with local codes, or in the absence of local codes, with the latest edition of the National Fuel Gas Code NFPA 54/ANSI Z223.1.

Natural Gas Capacity of Pipe  
In Cubic Feet of Gas Per Hour (CFH)

Length of Pipe in Feet	Nominal Black Pipe Size				
	1/2"	3/4"	1"	1 1/4"	1 1/2"
10	132	278	520	1050	1600
20	92	190	350	730	1100
30	73	152	285	590	980
40	63	130	245	500	760
50	56	115	215	440	670
60	50	105	195	400	610
70	46	96	180	370	560
80	43	90	170	350	530
90	40	84	160	320	490
100	38	79	150	305	460

(Pressure 0.5 psig or less and pressure drop of 0.3" W.C.; Based on 0.60 Specific Gravity Gas)

CFH =  $\frac{\text{BTUH Furnace Input}}{\text{Heating Value of Gas (BTU/Cubic Foot)}}$

To connect the furnace to the building's gas piping, the installer must supply a ground joint union, drip leg, manual shutoff valve, and line and fittings to connect to gas valve. In some cases, the installer may also need to supply a transition piece from 1/2" pipe to a larger pipe size.

The following stipulations apply when connecting gas piping. Refer to Figure 3 for typical gas line connections to the furnace.

- Use black iron or steel pipe and fittings for the building piping.
- Use pipe joint compound on male threads only. Pipe joint compound must be resistant to the action of the fuel used.
- Use ground joint unions.
- Install a drip leg to trap dirt and moisture before it can enter the gas valve. The drip leg must be a minimum of three inches long.
- Install a 1/8" NPT pipe plug fitting, accessible for test gage connection, immediately upstream of the gas supply connection to the furnace.
- Use two pipe wrenches when making connection to the gas valve to keep it from turning. The orientation of the gas valve on the manifold must be maintained as shipped from the factory.

- Install a manual shutoff valve between the gas meter and unit within six feet of the unit. If a union is installed, the union must be downstream of the manual shutoff valve, between the shutoff valve and the furnace.
- Tighten all joints securely.
- Connect the furnace to the building piping by one of the following methods:
  - Rigid metallic pipe and fittings.
  - Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing must not be used in exterior locations.
  - Listed gas appliance connectors, used in accordance with the terms of their listing, must be completely in the same room as the furnace.
  - Protect connectors and semirigid tubing against physical and thermal damage when installed. Ensure that any aluminum-alloy tubing and connectors are coated to protect against external corrosion when in contact with masonry, plaster or insulation or are subject to repeated wettings by such liquids as water (except rain water), detergents or sewage.

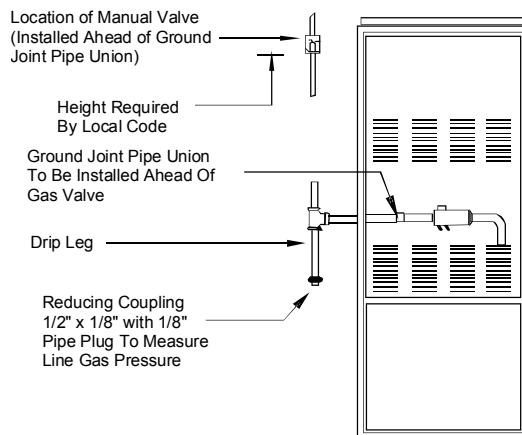


Figure 8  
General Furnace Layout

### Upflow Installations

When the gas piping enters through the right side of the furnace, the installer must supply the following fittings (starting from the gas valve):

- 90 degree elbow.
- Close nipple.
- 90 degree elbow.
- Straight pipe to reach the exterior of the furnace (Figures 9 & 10).

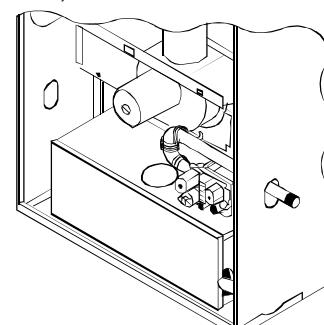
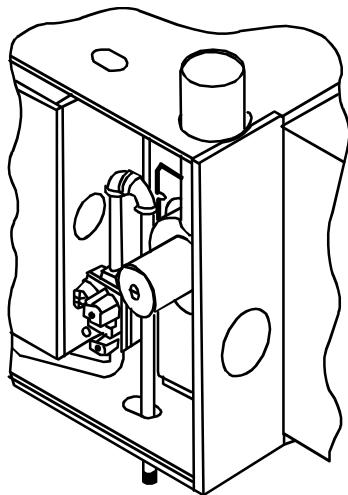


Figure 9  
Gas Inlet Through Furnace Right Side

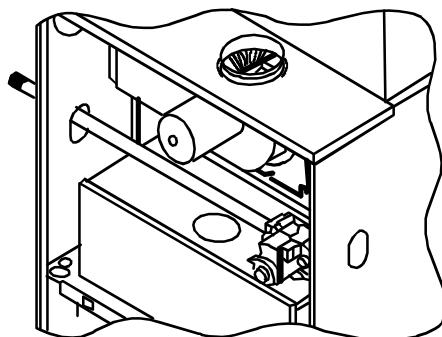
A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.



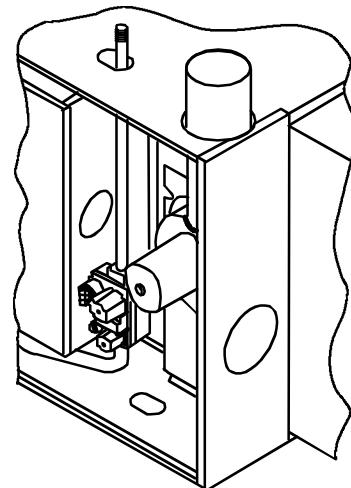
**Figure 10**  
**Gas Inlet Through Furnace Bottom Side**  
**(Upflow)**

When the gas piping enters through the left side of the furnace, the installer must supply the following fittings (starting from the gas valve):

- Straight pipe to reach the exterior of the furnace. See Figures 11 & 12.
- A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.

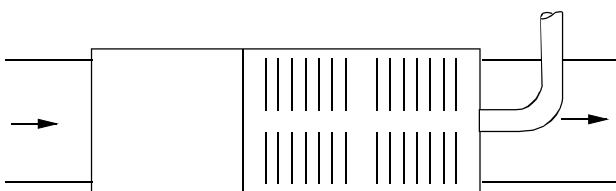


**Figure 11**  
**Gas Inlet Through Furnace Left Side**  
**(Upflow)**



**Figure 12**  
**Gas Inlet Through Furnace Top Side**  
**(Upflow)**

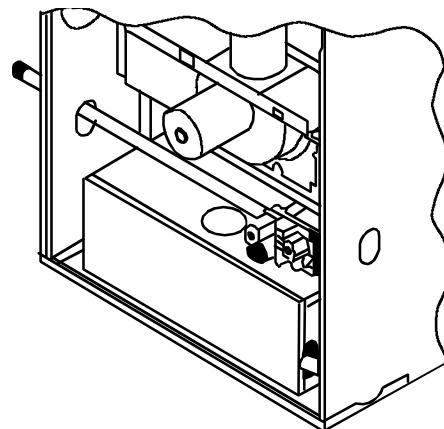
The gas piping connections shown in Figures 10 and 12 are for a furnace equipped for a right hand discharge (Figure 13). Adaptation for left hand discharge should be self explanatory.



**Figure 13**  
**Horizontal Furnace (Right Hand Discharge)**

#### Counterflow Installations

*When the gas piping enters through the left side of the furnace, the installer must supply a straight pipe to reach the exterior of the furnace (Figure 14).*



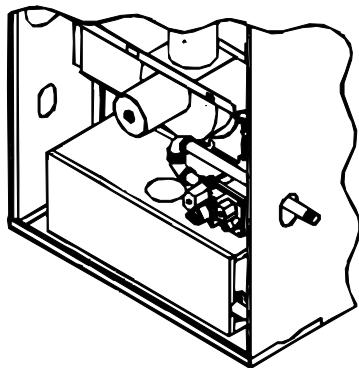
**Figure 14**  
**Gas Inlet Through Left Side**  
**(Counterflow)**

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.

When the gas piping enters through the right side of the furnace, the installer must supply the following fittings (starting at the gas valve):

- 90 degree elbow.
- Close nipple.
- 90 degree elbow.
- Straight pipe to reach exterior of furnace (Figure 15).

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.



**Figure 15**

#### **Gas Inlet Through Right Side (Counterflow)**

"Left side" and "right side" above are as viewed for a counterflow installation. Adaptation for horizontal airflow should be self explanatory.

#### **Gas Piping Checks**

Before placing in operation, leak test the unit and gas connections.



#### **WARNING**

**To avoid the possibility of explosion or fire, never use a match or open flame to test for leaks.**

Check for leaks using an approved chloride-free soap and water solution, an electronic combustible gas detector, or other approved testing methods.



#### **CAUTION**

**To prevent personal injury or property damage due to fire, the following instructions must be performed regarding gas connections, pressure testing, location of shutoff valve, and installation of gas piping.**

**NOTE:** Never exceed specified pressures for testing. Higher pressure may damage the gas valve and cause subsequent overfiring, resulting in heat exchanger failure. To avoid the possibility of explosion or fire, never use a match or open flame to test for leaks.

This unit and shutoff valve must be disconnected from the gas supply piping system before supply piping system pressure testing with test pressures in excess of 1/2 psig (3.48 kPa).

This unit must be isolated from the gas supply system by closing its manual shutoff valve before pressure testing of gas supply piping system with test pressures equal to or less than 1/2 psig (3.48 kPa).

#### **Propane Gas Tanks and Piping**



#### **WARNING**

**Propane gas is heavier than air and any leaking gas can settle in any low areas or confined spaces. To prevent death, personal injury, or property damage due to fire or explosion caused by a propane gas leak, install a gas detection warning device.**

A gas detecting warning device is the only reliable way to detect a propane gas leak. Rust can reduce the level of odorant in propane gas. Contact a local propane gas supplier about installing a gas detecting warning device. If the presence of gas is suspected follow the warning instructions on page 2 of this manual.

All propane gas equipment must conform to the safety standards of the National Board of Fire Underwriters (NBFU Manual 58).

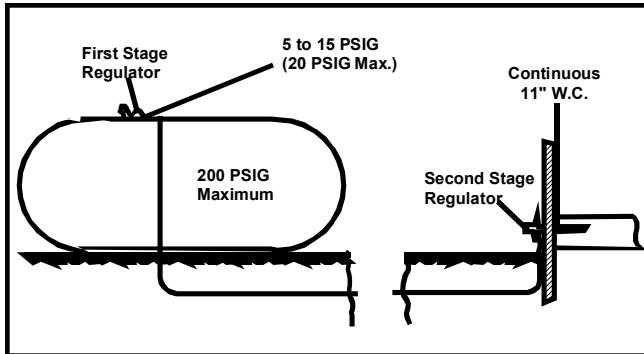
For satisfactory operation, propane gas pressure must be 10 inch WC at the furnace manifold with all gas appliances in operation. Maintaining proper gas pressure depends on three main factors:

1. Vaporization rate, depending on temperature of the liquid, and "wetted surface" area of the container or containers.
2. Proper pressure regulation. Two-stage regulation is recommended for both cost and efficiency.
3. Pressure drop in lines between regulators, and between second stage regulator and the appliance. Pipe size will depend on length of pipe run and total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and propane gas suppliers.

Since propane gas will quickly dissolve white lead or most standard commercial compounds, special pipe dope must be used. Shellac base compounds resistant to the actions of liquefied petroleum gases such as Gasolac®, Stalactic®, Clyde's® or John Crane® are satisfactory.

Refer to Figure 16 for typical propane gas installations.



**Figure 16**  
**Typical Propane Gas Installations**

### PROPANE GAS PIPING CHARTS

Sizing Between First and Second Stage Regulator

Maximum Propane Capacities listed are based on 2 psig pressure drop at 10 psig setting.  
Capacities in 1,000 BTU/hour.

Pipe or Tubing Length, Feet	Tubing Size, O.D. Type L					Nominal Pipe Size Schedule 40	
	3/8"	1/2"	5/8"	3/4"	7/8"	1/2"	3/4"
10	730	1,700	3,200	5,300	8,300	3,200	7,500
20	500	1,100	2,200	3,700	5,800	2,200	4,200
30	400	920	2,000	2,900	4,700	1,800	4,000
40	370	850	1,700	2,700	4,100	1,600	3,700
50	330	770	1,500	2,400	3,700	1,500	3,400
60	300	700	1,300	2,200	3,300	1,300	3,100
80	260	610	1,200	1,900	2,900	1,200	2,600
100	220	540	1,000	1,700	2,600	1,000	2,300
125	200	490	900	1,400	2,300	900	2,100
150	190	430	830	1,300	2,100	830	1,900
175	170	400	780	1,200	1,900	770	1,700
200	160	380	730	1,100	1,800	720	1,500

To convert to capacities at 15 psig settings - multiply by 1.130

To convert to capacities at 5 psig settings - multiply by 0.879

Sizing Between Single or Second Stage Regulator and Appliance\*

Maximum Propane Capacities Listed are Based on 1/2" W.C. pressure drop at 11" W.C. setting  
Capacities in 1,000 BTU/hour.

Pipe or Tubing Length, Feet	Tubing Size, O.D. Type L					Nominal Pipe Size Schedule 40					
	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
10	39	92	199	329	501	935	275	567	1,071	2,205	3,307
20	26	62	131	216	346	630	189	393	732	1,496	2,299
30	21	50	107	181	277	500	152	315	590	1,212	1,858
40	19	41	90	145	233	427	129	267	504	1,039	1,559
50	18	37	79	131	198	376	114	237	448	913	1,417
60	16	35	72	121	187	340	103	217	409	834	1,275
80	13	29	62	104	155	289	89	185	346	724	1,066
100	11	26	55	90	138	255	78	162	307	630	976
125	10	24	48	81	122	224	69	146	275	567	866
150	9	21	43	72	109	202	63	132	252	511	787
200	8	19	39	66	100	187	54	112	209	439	665
250	8	17	36	60	93	172	48	100	185	390	590

\*Data in accordance with NFPA pamphlet NO. 54

## VI. Electrical Wiring



### WARNING

To prevent death or personal injury due to electric shock, disconnect electrical power before changing any electrical wiring.

### CAUTION

When servicing controls, label all wires before disconnecting. Wiring errors can cause improper and dangerous operation. After servicing is completed, always verify proper operation.

The unit wiring harness is an integral part of the furnace. Field alteration to comply with electrical codes should not be required.

Power supply to the furnace must be NEC Class 1, and must comply with all applicable codes. The furnace must be electrically grounded in accordance with the local codes or, in their absence, with the latest edition of the National Electrical Code, ANSI NFPA No. 70 and/or the CSA C22.1 Electrical Code. A fused disconnect must be provided and sized in accordance with the unit maximum overcurrent protection.

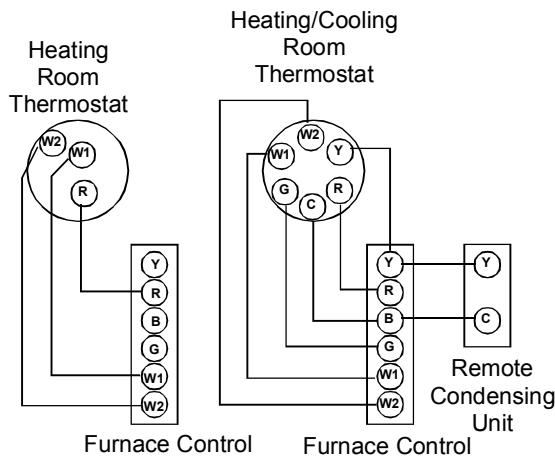
### THERMOSTAT REQUIREMENTS

A two stage thermostat must be used with this furnace. A two stage furnace will have both "W1" and "W2" terminals. Figure 17 shows connections for heat only two stage system and a two stage heating/one stage cooling system. If the thermostat has "Y1" and "Y2" connections and a one stage cooling system is used, connect "Y" on the furnace control to "Y1" on the thermostat.

### CONTINUOUS FAN OPERATION

The two stage furnace control will energize the low heat circulator fan speed when the fan switch on the thermostat is turned to the "ON" position. This fan speed will provide circulation with less electricity than conventional single stage equipment.

**NOTE:** For two stage heat only (no cooling) applications, the continuous fan speed may be increased by placing a jumper between "Y" to "G". Thermostat must have a "G" terminal to make use of this feature.



**Figure 17**  
**Typical Field Wiring**  
**(24 VAC Control Circuit)**

A 40 VA transformer and an integrated electronic control are built into the furnace to allow use with most cooling equipment.



## CAUTION

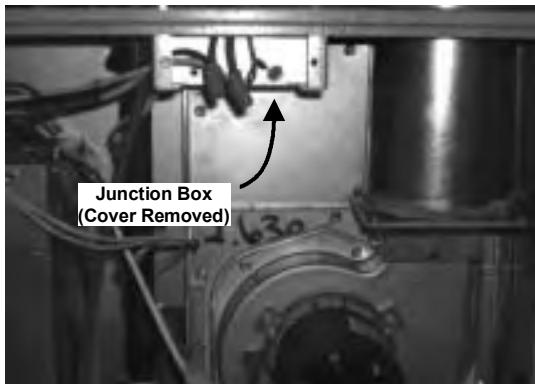
**To avoid the risk of electrical shock, wiring to the unit must be properly polarized and grounded.**

To provide more reliable sensing of flame, the *ground wire* must run to the electrical panel.

*Line voltage wiring* must enter into the junction box provided with the furnace.

As shipped, the junction box is attached to the left side of the furnace (as viewed for an upflow installation). If this is suitable for your installation, no changes are necessary.

If the line voltage wiring is to enter through the right side of the furnace (as viewed for an upflow installation), relocate the junction box as shown in Figure 18.



**Figure 18**  
**Junction Box (Horizontal Right)**



## WARNING

**To prevent death or personal injury due to electric shock, disconnect electrical power.**

1. Remove both doors from the furnace.
2. Remove and save the screws holding the junction box to the left side of the furnace.
3. Disconnect the hose from the pressure switch assembly. Leave the other end attached to the induced draft blower.
4. Remove four wires to the pressure switch assembly.
5. Remove and save the screws holding the pressure switch bracket to the right side of the furnace.
6. Remove wires entering junction box from split grommet in blower deck.
7. Swap locations of the two bushings in the junction box.
8. Rotate the junction box 180° so the access panel continues to face forward. The open snap bushing should be on the left.

9. Attach pressure switch bracket to left side of furnace where the junction box was using the screws saved in Step 5. The "L" bracket must point toward the front of the furnace. Reroute pressure switch wires through the split grommet on the left side of the blower deck. Reconnect wires using the wiring diagram inside the blower door.

10. Reroute remaining wires through split grommet on the right side of the blower deck.

11. Insert remaining wires through the open bushing in the bottom of the junction box.

12. Attach junction box to the right side of the furnace using the screws removed in Step 2.

13. Reconnect hose to pressure switch assembly.

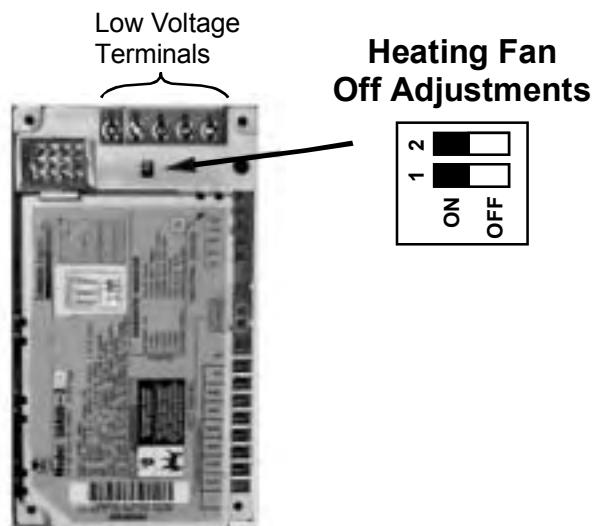
14. Check the location of the pressure hose and all wiring. Ensure the hoses will not be damaged by heat from the burners or by the rotation of the fan. Also ensure all wiring will not interfere with filter removal or other maintenance.

After the junction box is in the desired location, use washers to connect field-supplied conduit to the junction box in accordance with NEC and local codes. Connect hot, neutral, and ground wires as shown in the furnace wiring diagram. The wires and ground screw are located in the furnace junction box.

Low voltage wiring may enter through the right or left side of the furnace (as viewed for an upflow installation - top or bottom for a horizontal installation). See Specification Sheet for hole locations. Run the thermostat wires through either hole and down through a grommet in the blower deck.

Low voltage wires may be connected to the terminal strip as shown in Figure 19.

**IMPORTANT NOTE:** To avoid possible equipment malfunction, route the low voltage wires to avoid interference with filter removal or other maintenance.



**Figure 19**  
**Integrated Ignition Control**  
**(Viewed in an Upflow Installation)**

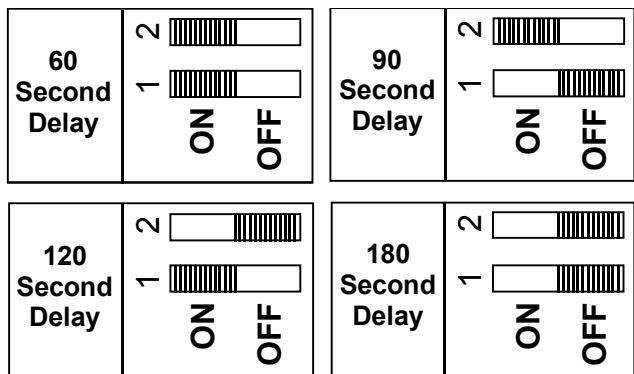
## AIR CIRCULATION BLOWER TIMING

All items in this section refer to the air circulation blower, not to the induced draft blower. The timing sequence for the induced draft blower is not adjustable.

When a call for cooling occurs, the air circulation blower will come on. It will remain on for 45 seconds after the call for cooling ends. This fan timing is not adjustable.

During normal heating operation, the air circulation blower will come on 37 seconds after the gas valve opens. This timing is not adjustable.

As shipped, the air circulation blower will remain on for 90 seconds after the gas valve closes. If desired, this timing may be adjusted. The adjustment switches are near the low voltage terminal strip. See Figure 20.



**Figure 20**  
**Switches**  
(Viewed in an Upflow Installation)

## LINE VOLTAGE CONNECTION FOR OPTIONAL HUMIDIFIER AND ELECTRONIC AIR CLEANER

The control module is equipped with line voltage accessory terminals used for controlling the power to an optional field-supplied humidifier and/or electronic air cleaner.

### Accessory Load Specification

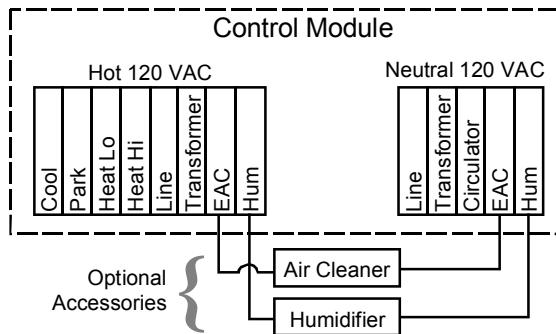
Air Cleaner: 1.0 Amp max. at 120 VAC

Humidifier: 1.0 Amp max. at 120 VAC

### Accessory Installation:

Follow the electronic air cleaner and humidifier manufacturers' instructions for mounting and electrically grounding these accessories. Check that the power supply to the furnace has been disconnected. Wire the accessories to the control module as shown below. All connections to the control module are to be made through 1/4" female terminals.

If it is necessary to supply additional line voltage wiring to the interior of the furnace, the wiring must comply with all local codes. This wiring must have a minimum temperature rating of 105°C and must be routed away from the burner compartment. All line voltage wire splices must be made inside the furnace junction box.



**Figure 21**  
**Accessory Operation**

**Accessory Operation:** The furnace control module energizes the humidifier whenever the induced draft blower is energized (when an air cleaner is installed on the system, the humidifier is not energized until the air cleaner is energized). The control module energizes the air cleaner whenever the air circulation blower is energized.

## VII. Circulating Air and Filters

### DUCTWORK - AIR FLOW

Duct systems and register sizes must be properly designed for the CFM and external static pressure rating of the furnace. Ductwork should be designed in accordance with the recommended methods of "Air Conditioning Contractors of America" Manual D.

A duct system must be installed in accordance with Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating and Ventilating Systems. Pamphlets No. 90A and 90B. Ductwork must never be attached to the back of the furnace.

A closed return duct system must be used, with the return duct connected to the furnace. Supply and return connections to the furnace may be made with flexible joints to reduce noise transmission. To prevent the blower from interfering with combustion air or draft when a central return is used, a connecting duct must be installed between the unit and the utility room wall. A room, closet, or alcove must not be used as a return air chamber.

When the furnace is used in connection with a cooling unit, the furnace should be installed in parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element. With a parallel flow arrangement, the dampers or other means used to control the flow of air must be adequate to prevent chilled air from entering the furnace and, if manually operated, must be equipped with means to prevent operation of either unit unless the damper is in the full heat or cool position.

When the furnace is installed without a cooling coil, it is recommended that a removable access panel be provided in the outlet air duct. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for visual light inspection or such that a sampling probe can be inserted into the air-stream. The access panel must be made to prevent air leaks when the furnace is in operation.

When the furnace is heating, the temperature of the return air entering the furnace must be between 55°F and 100°F.

When a furnace is installed so that supply ducts carry air circulated by furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct sealed to the furnace casing and terminating outside the space containing the furnace.

### **FILTERS - READ THIS SECTION BEFORE INSTALLING THE RETURN AIR DUCTWORK**

Filters must be used with this furnace. Discuss filter maintenance with the building owner. Filters do not ship with this furnace, but must be provided by the installer. Filters must comply with UL900 or CAN/ULCCS111 standards. If the furnace is installed without filters, the warranty will be voided.

Guide dimples locate the side return cutout locations. Use a straight edge to scribe lines connecting the dimples. Cut an opening to match the dimensions of these lines.

**NOTE:** An undersized opening will cause reduced airflow. The bottom return is set up as a knock out.

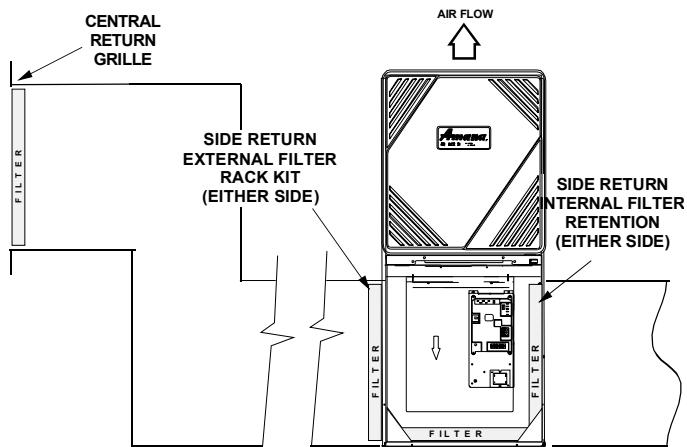
For air delivery of less than 1800 CFM, use a one side or bottom return.

For air delivery of 1800 CFM or higher, use either two-sided returns or a one-sided return with a bottom return.

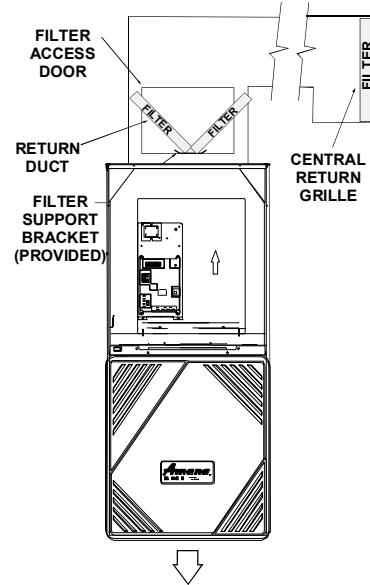
To ensure proper unit performance follow the filter sizes given in the Specifications Sheet.

### **UPRIGHT INSTALLATIONS**

Depending on the installation and/or customer preference, differing filter arrangements can be applied. Filters can be installed in the central return register, the bottom of the blower compartment (upflows), a side panel external filter rack kit - EFR01 (upflows), inside the side panel (upflows), or the ductwork above a counterflow furnace. As an alternative a media air filter (MAC1) or electronic air cleaner (EAC5) can be used as the requested filter. Review and follow the filter sizes given in the Specifications Sheet to ensure proper unit performance. The following figures show possible filter locations.



**Figure 26**  
**Possible Upright Upflow**  
**Filter Locations**



**Figure 27**  
**Possible Upright Counterflow**  
**Filter Locations**

### **HORIZONTAL INSTALLATIONS**

Filters must be installed in either the central return register or in the return air duct work.

Refer to the Specification Sheet for recommended minimum filter sizes.

## **VIII. Sequence of Operation**

*Refer to Timing Charts for sequencing.*

### **NORMAL HEATING SEQUENCE**

1. Thermostat calls for heat (high heat or low heat).
2. The induced draft blower is energized on high speed for a 10 second prepurge.
3. The induced draft blower is energized on low speed.
4. The igniter is energized and is allowed to preheat for 17 seconds.
5. The gas valve is energized delivering gas to the burners at the low stage heat flow rate.
6. The control checks for a signal from the flame sensor within seven seconds after the gas valve is energized (opens). Gas will only continue to flow if a signal is present.
7. The control checks the thermostat to see whether the call for heat is for low stage heat or high stage heat. If the call is for high stage heat, the induced draft blower is switched to high speed and the gas valve is energized on high flow rate.
8. The control waits 30 seconds and turns on the air circulation blower to the appropriate speed (high heat speed for high heat or low heat speed for low heat). On some Amana models, the high heat air circulator speed may be the same as the low heat circulator speed. These models are factory shipped to be within the rise range on both stages with the same air circulator speed.

9. The furnace is now operating on the specified stage called out by the two stage thermostat.
10. If the two stage thermostat changes the call from low heat to high heat, the control will immediately switch the induced draft blower gas valve, and air circulating speed to their high stage setting.
11. If the two stage thermostat changes the call from high heat to low heat, the control will immediately switch the induced draft blower to low speed and switch the flow rate on the gas valve to low. The air circulation blower will remain on high heating speed for thirty seconds before switching to the low heat circulating speed. The 30 second delay feature on the circulator speed eliminates the possibility of tripping the high (primary) limit when the high stage flue products are traveling through the heat exchanger upon a call for low stage heat.
12. The two stage thermostat is satisfied and opens.
13. The control turns the gas valve off.
14. After a five second delay while flue products are purged from the heat exchanger, the induced draft blower is turned off (the induced draft blower is on low speed during the first five seconds post purge).
15. The air circulation blower has an adjustable delay-off timing of 60, 90, 120, or 180 seconds (starting from the time the gas valve closes). The speed(s) run during this period depend on the last heat call seen by the thermostat.

If the last call for heat was a call for low heat, the air circulation blower will run on the low heat speed for the duration of the adjusted delay-off timing (60, 90, 120, or 180 seconds).

If the last call for heat was a call for high heat, the air circulation blower will run on the high heating speed for thirty seconds and then switch to the low heating speed for the **balance** of the adjusted delay-off timing (30, 60, 90, or 150 seconds).

Example: A GUI090CA50 has the air circulation blower off delay set to 120 seconds by the installer. When the thermostat is satisfied after a call for high heat, the air circulation blower will run on high speed for 30 seconds and then switch to low circulator speed for  $120 - 30 = 90$  seconds.

The adjustable delay-off timing allows more heat transferred to the conditioned space from the furnace. After the delay time has elapsed, the air circulation blower is de-energized. The adjustable delay-off timing feature allows the installer to customize the comfort level based on the predominant staging requirements of the living space.

## IX. Start-Up, Adjustments, and Checks

### GENERAL OPERATION

This furnace is equipped with an electronic ignition device to light the burners and an induced draft blower to exhaust combustion products.

An interlock switch prevents furnace operation if the blower door is not in place. Keep the blower access doors in place except for inspection and maintenance.

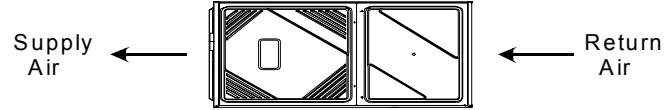
This furnace is also equipped with a self-diagnosing electronic control module. In the event a furnace component is not operating properly, the control module LED will flash on and off in a factory-programmed sequence, depending on the problem encountered. This light can be viewed through the observation window in the blower access door. Refer to the *Diagnostic Signal Chart* for further explanation of the lighting codes and Section IX, *Abnormal Operation - Integrated Ignition Control* for an explanation of the possible problem.

On new installations, or if a functional part such as the gas valve, pressure switch, or limit control has been replaced, the operation of the furnace should be checked.

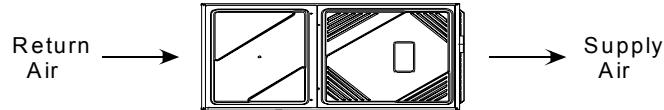
Check furnace operation as outlined in the following instructions. If any sparking, odors, or unusual noises are encountered, shut off electrical power and recheck for wiring errors, or obstructions in or near the blower motors. Various shipping materials must be removed before the blower motor is operated.

### ROLLOUT PROTECTION DEVICE

**IMPORTANT NOTE:** This furnace is equipped with a device to close the gas valve if the burner flames are not drawn into the heat exchanger. **GUI**\_ furnaces installed horizontal right-to-left airflow, the device must be relocated. **GCI**\_ furnaces installed horizontal left-to-right airflow, the device must be relocated.



**Figure 28**  
**Right To Left Installation**



**Figure 29**  
**Left To Right Installation**

If relocation is required, proceed as follows:

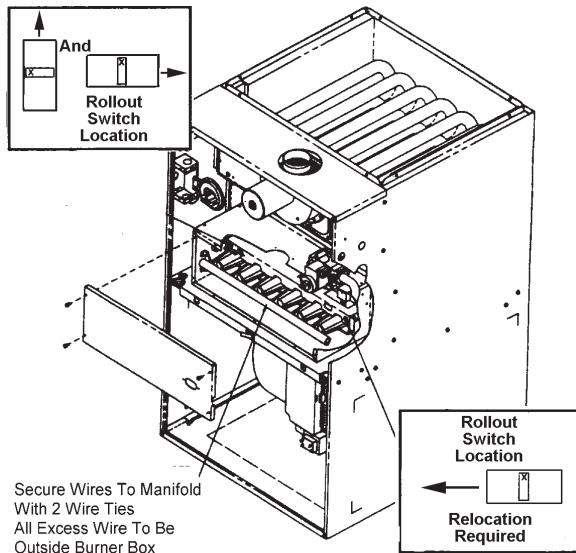
1. Disconnect electrical power.



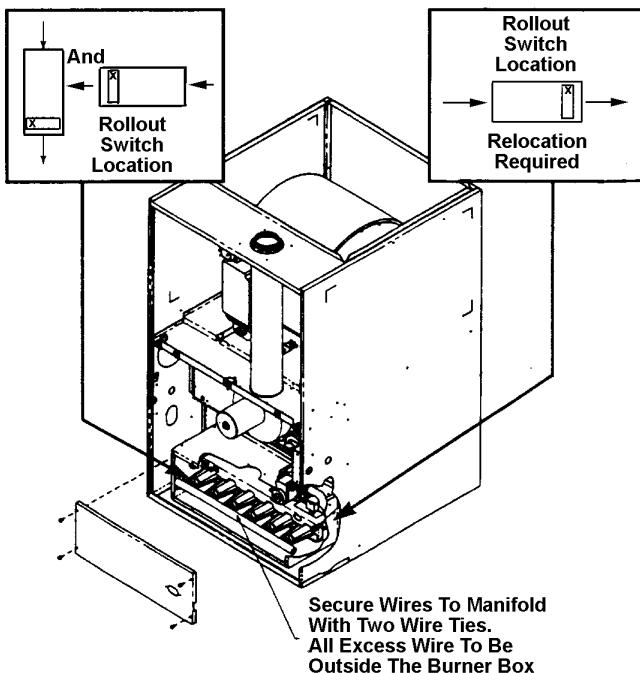
**To prevent death or personal injury due to electric shock, disconnect electrical power.**

2. See Figures 30 & 31. Remove the cover from the burner box. Save the screws that held it in place. (**Note:** There are several screw holes, but only four screws. This is intentional, and not a manufacturing defect.)
3. As shipped, the rollout protection device is located near the flame sensor end of the manifold assembly. Remove and save the mounting screws.
4. For most installations, it will not be necessary to remove the wires from the rollout protection device.

5. For horizontal-left installations, a hole is provided near the igniter end of the manifold assembly. Insert the rollout protection device into this hole and attach with screws removed in Step 3.



**Figure 30**  
**Rollout Switch Relocation (Upflow)**



**Figure 31**  
**Rollout Switch Relocation  
(Counterflow Installation)**

6. Secure rollout wires to manifold and insure no wires can come in contact with burners or other hot surfaces.

7. Push the button to confirm the rollout control is in the closed position.

8. Replace the cover on the burner box, replacing the screws from Step 2.

## **WARNING**

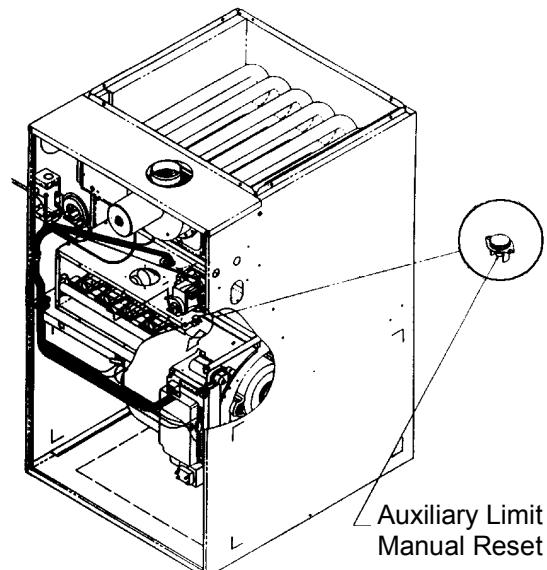
To prevent death, personal injury or property damage due to fire or explosion, a qualified servicer must determine the reason the rollout protection device opened before the device is reset.

### **BURNER BOX**

This furnace must use indoor air for combustion. It is not a direct vent furnace, and it cannot be installed as a direct vent furnace. The burner box is present only to reduce the burner sound transmission.

### **AUXILIARY LIMIT CONTROL**

A manual reset limit is located on the blower side of the blower deck, near the center. To access this auxiliary limit, disconnect the electrical power and remove the blower door. If the limit control opens, the air circulation blower and induced draft blower will run continuously. The diagnostic light will flash four times. These symptoms are identical to a trip of the primary limit control. See Section IX for diagnosis.



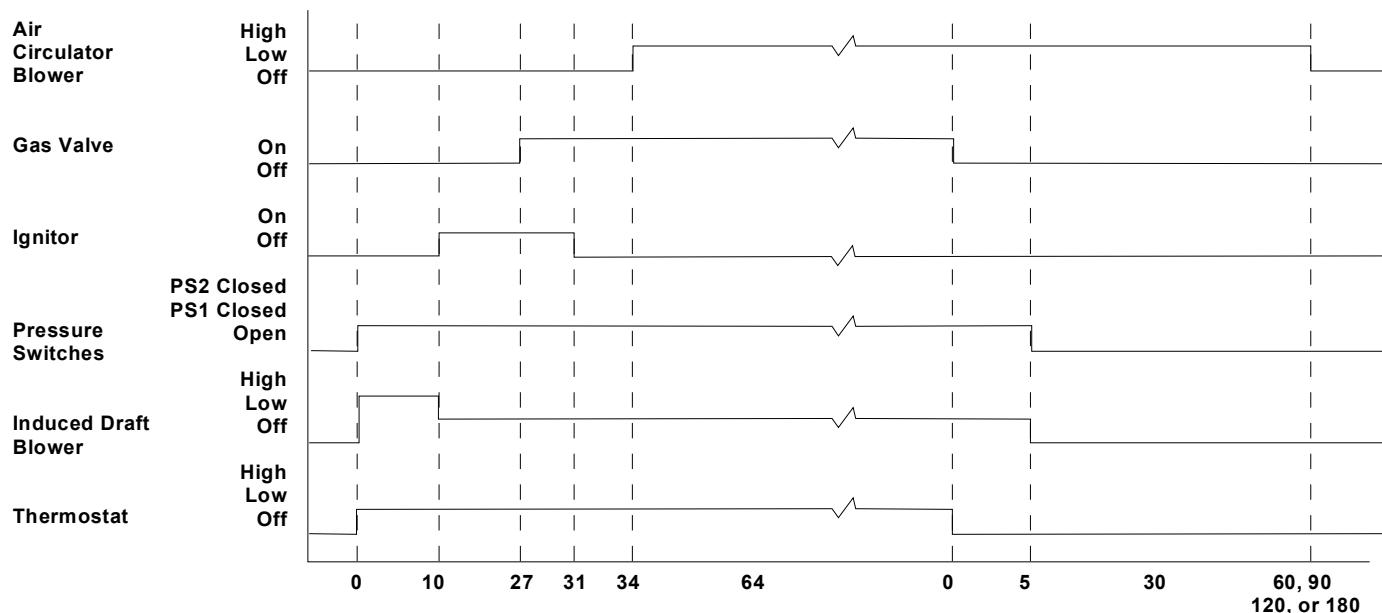
**Figure 32**  
**Auxiliary Limit Control**

The auxiliary limit control is designed to prevent furnace operation in case of air circulation blower failure on horizontal installations. It may also open if the power supply is interrupted while the furnace is firing.

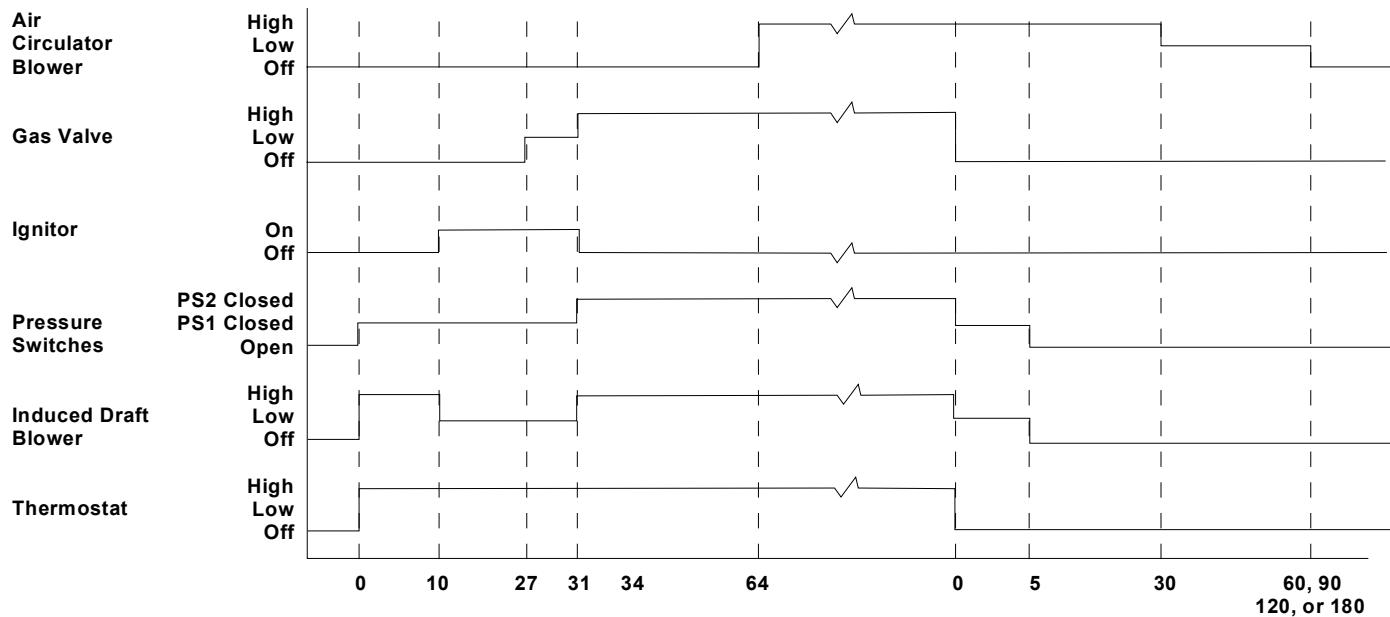
The auxiliary limit control is suitable for both horizontal right and horizontal left installations. Regardless of airflow direction, it does not need to be relocated.

## Timing Charts For Two Stage Integrated Ignition Control Operation

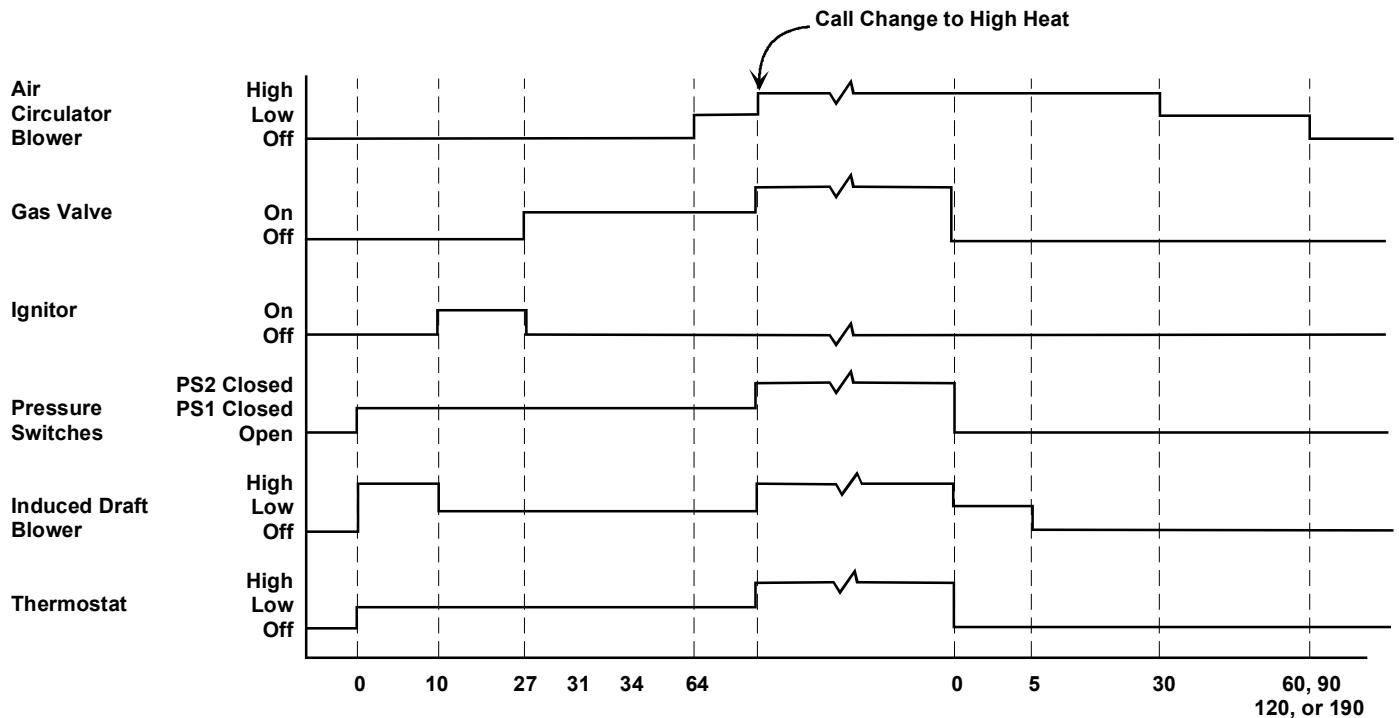
### Example 1: Continuous Call For Low Stage Heat Only



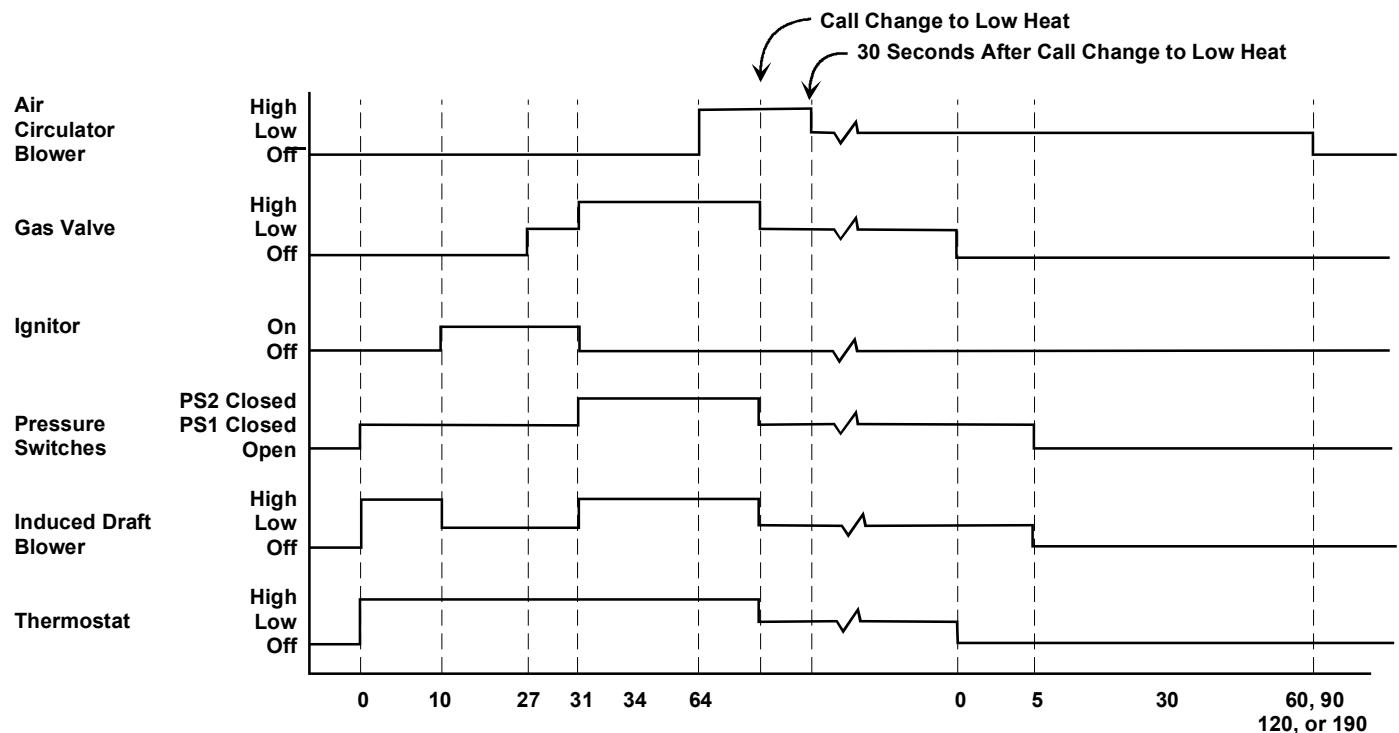
### Example 2: Continuous Call For High Stage Heat Only



### Example 3: Initial Call For Low Heat, Change In Call To High Heat



### Example 4: Initial Call For High Heat, Subsequent Call To Low Heat

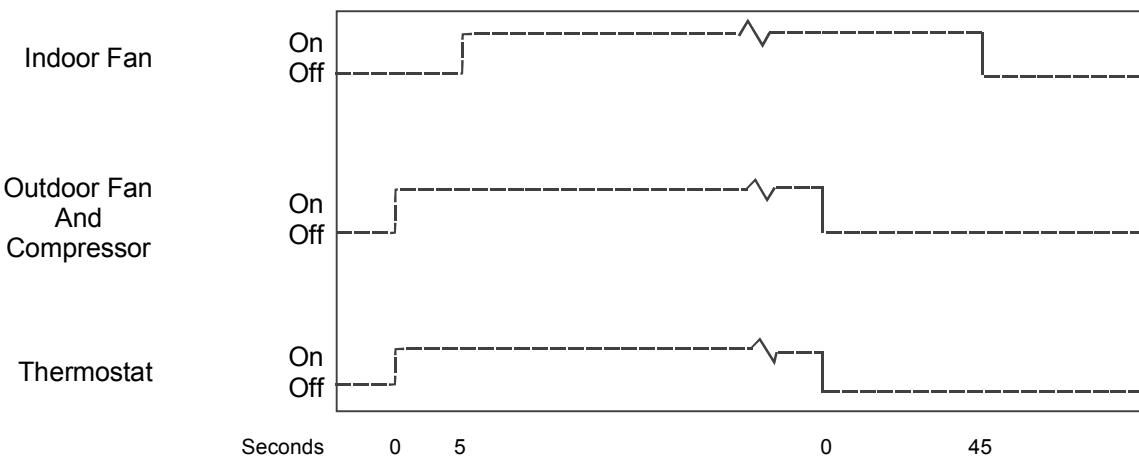


## Integrated Ignition Control

### Diagnostic Signal Chart

Light Signal	For Corrective Action Refer to Abnormal Operation Number
Continuous Light	
1 Flash	1 Internal Lockout
2 Flashes	2 External Lockout
3 Flashes	3 Pressure Switch Stuck Closed
4 Flashes	4 Pressure Switch Stuck Open
Continuous Flashing	5 Thermal Protection Device Open
	6 Flame Sensed - No Call For Heat Stat Recovery (1/4 Second on, 1/4 Second off)

### Timing Chart for Normal Cooling Operation





## WARNING

**To prevent death, personal injury or property damage due to fire, follow these directions for the auxiliary limit control. If the auxiliary limit control opens, it may be reset one time only.**

**SERVICER'S NOTE:** If it becomes necessary to slide the air circulation blower assembly out of the furnace, the auxiliary limit control should be removed first. After the air circulation blower assembly is reinstalled, the auxiliary limit must be reinstalled.

### **ABNORMAL OPERATION - INTEGRATED IGNITION CONTROL**

The following presents the probable causes of questionable furnace operation and how to fix them. Look through the observation window in the air circulation blower access door and make a note of the number of flashes in sequence between pauses. Next, refer to the *Diagnostic Signal Chart* for an interpretation of the signals and to this section for a description.

#### **1. Internal Lockout**

An internal lockout occurs when the integrated ignition control senses an internal problem and stops the unit. The diagnostic light will indicate the condition with a **continuous** light.

To solve this problem, replace the ignition control.

#### **2. External Lockout**

A external lockout occurs when the integrated ignition control determines that a measurable combustion cannot be established or maintained after three consecutive tries (four, if flame is established then lost) to turn on the furnace.

If a flame is not sensed during the first seven seconds after a gas valve has been energized, the ignition control will internally turn off the gas. After 120 seconds, during which time the induced draft blower purges the heat exchanger, the igniter will reenergize and preheat for 27 seconds. The gas valve is then reenergize. If a flame is not sensed again in seven seconds, the gas valve will de-energize and another purge is performed. The ignition control will cycle the gas valve *three times* before it determines it cannot establish measurable combustion and enter a lockout state. If a flame is sensed but lost after 10 seconds, the control will cycle *four more times* before locking out. A lockout stops ignition attempts and causes the air circulation blower to run continuously. The diagnostic light will indicate either condition with **one short flash** followed by a longer off.

The control can be reset and brought out of lockout mode by turning the thermostat off and then back on. It can also be reset by turning off the electrical disconnect switch to the furnace for 30 seconds. The control will reset after two hours.

**IMPORTANT:** If you have to frequently reset your furnace, it means that a problem exists that should be corrected. Contact a qualified servicer for further information.

#### **3. Pressure Switch Stuck Closed**

A sticking pressure switch can be caused by either a faulty pressure switch, faulty wiring, a disconnected hose, or a restricted intake or flue piping. In the case of a pressure switch sticking closed, the probable cause is a faulty pressure switch or wiring.

If the ignition control senses that the pressure switch is closed and the induced draft blower is off, it will shut down the unit until the fault is corrected. The light code for this problem is **two short flashes** followed by a longer pause.

#### **4. Pressure Switch Stuck Open**

A sticking open pressure switch can be caused by a faulty pressure switch, a disconnected hose to the pressure switch, a restricted air intake or flue piping, or faulty wiring.

If the ignition control senses that the induced draft blower is energized but the pressure switch is not closed, the control will keep the air circulation blower on and wait for the switch to close. The diagnostic light code for this problem is **three short flashes** followed by a pause.

#### **5. Open Thermal Protection Device**

If the primary (high) limit, auxiliary limit, or rollout limit control opens, the gas valve is de-energized. Both the induced draft blower and air circulation blower are energized on low heat speed. The diagnostic light code for this is **four short flashes** followed by a longer pause.

If the primary or auxiliary limit is open, the probable cause is either: low conditioned air flow due to a dirty filter or high resistance in duct work, a faulty limit, a faulty air circulation blower or an air circulation blower speed set too low. The primary limit will automatically reset; however, the auxiliary limit control must be manually reset.

If the rollout limit control is open, the probable cause is insufficient combustion air, restricted flue passage, or restricted heat exchanger. The rollout limit control must be manually reset.

#### **6. Flame Sensed with No Call for Heat**

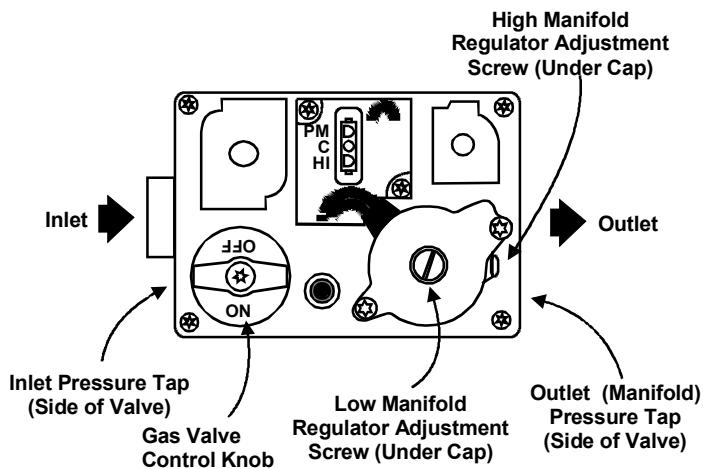
If the control senses a flame when the gas valve is de-energized, it will run the air circulation blower and the induced draft blower continuously. The diagnostic light code for this is **continuous light flashing**. Probable cause is miswiring.

### **OPERATING INSTRUCTIONS**

1. Close the manual gas valve external to the furnace.
2. Turn off the electrical power supply to the furnace.
3. Set room thermostat to lowest possible setting.

4. Remove the door on the front of the furnace.
5. This furnace is equipped with an ignition device to automatically light the burners. Do not try to light burners by hand.
6. Turn the gas control knob clockwise  to the Off position (Figure 33). The knob should turn easily. Do not use excessive force.
7. Wait five minutes to clear out any gas. Then smell for gas, including near the floor.
8. If gas can be smelled following the five minute waiting period in Step 7, follow the instructions on Page 2 of this manual. If gas can not be smelled, turn the gas control knob counterclockwise  to the On position (Figure 33). The knob should turn easily. Do not use excessive force.
9. Replace the door on the front of the furnace.
10. Open the manual gas valve external to the furnace.
11. Turn on the electrical power supply to the furnace.
12. Set the room thermostat to the desired temperature.

**NOTE:** There is an approximate 30 second delay between thermostat energizing and burner firing.



**Figure 33**  
**White Rodgers Model 36E96**

#### **GAS PRESSURES, ADJUSTMENTS, AND INPUT**

Gas supply pressure and manifold pressure with the burners operating must be as specified on the rating plate.

#### **Gas Pressure**

Gas inlet pressure should be checked and adjusted in accordance to the type of fuel being consumed.

#### *With Power and Gas Off:*

1. Connect a water manometer or adequate gauge to the "inlet pressure tap" of the gas valve (See Figure 33).

As an alternative method, inlet gas pressure can also be measured by removing the cap from the drip leg and installing a predrilled cap with a hose fitting (See Figure 35).

#### *With Power and Gas On:*

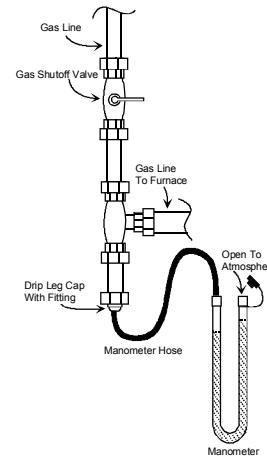
2. Put furnace into heating cycle and turn on all other gas consuming appliances.

Inlet Gas Pressure	
Natural	Min. 5.0" W.C., Max. 10.0" W.C.
Propane	Min. 11.0" W.C., Max. 13.0" W.C.

**Figure 34**  
**Inlet Gas Pressure**

**Note:** Inlet Gas Pressure Must Not Exceed the Maximum Value Shown.

If operating pressures differ from above, make necessary pressure regulator adjustments, check piping size, etc., and/or consult with local utility.



**Figure 35**  
**Measuring Inlet Gas Pressure (Alternate Method)**

#### **Gas Manifold Pressure Measurement and Adjustment**

**NOTE:** The gas manifold pressure must be measured with the burners operating.

Connect a "U-Tube" manometer having a scale range from 0 to 12 inches of water to the tapped opening in the gas valve. See "Outlet (Manifold) Pressure Tap" in Figure 33. Check your measurements. For natural gas, the manifold pressure must be between 3.0 and 3.6 inches water column (3.5 nominal). The low stage manifold pressure must be between 1.6 and 2.2 inches water column (1.9 nominal). For propane gas, it must be between 9.7 and 10.3 inches water column (10.0 nominal). The low stage manifold pressure must be between 5.7 and 6.3 inches water column (6.0 nominal). Any major changes in flow should be made by changing the size of the burner orifice.

If pressure adjustments are necessary, make them in small variations. To adjust, use the pressure regulator. Remove the adjustment screw or cover on the gas valve. Using a 3/32" Allen wrench, turn out (counterclockwise) to decrease pressure, turn in (clockwise) to increase pressure.

## Gas Adjustments

### Natural Gas

1. Adjust the high stage regulator to required manifold pressure setting.
2. Reinstall high stage cap screw.
3. Recheck manifold pressure setting with cap on.
4. Adjust low stage regulator to required manifold pressure setting.
5. Reinstall low stage cap screw.
6. Make sure furnace operates at the proper manifold pressure at both high and low stage outputs.

### Propane Gas

1. Adjust the low stage regulator to increase low stage output so furnace will light and carryover.
2. Adjust the high stage regulator to required manifold pressure setting.
3. Reinstall high stage cap screw.
4. Recheck manifold pressure setting with cap on.
5. Adjust low stage regulator to required manifold pressure setting.
6. Reinstall low stage cap screw.
7. Make sure furnace operates at the proper manifold pressure at both high and low stage outputs.

### Gas Input Rate measurement (Natural Gas Only)

The gas input rate to the furnace must never be greater than that specified on the unit rating plate. To measure natural gas input using the gas meter, use the following procedure.

1. Turn OFF the gas supply to all other gas-burning appliances except the furnace.
2. While the furnace is operating in low stage, time and record one complete revolution of the smallest gas meter dial.
3. Calculate the number of seconds per cubic foot (sec/ ft<sup>3</sup>) of gas being delivered to the furnace. If using a one cubic foot dial, divide the number of seconds recorded in step 2 by one. If the dial is a two cubic foot dial, divide the number of seconds recorded in step 2 by two.
4. Calculate the furnace input in BTUs per hour (BTU/hr). Input equals the sum of the installation's gas heating value and a conversion factor (hours to seconds) divided by the number of seconds per cubic foot. The measured input must not be greater than the input indicated on the unit rating plate.

#### EXAMPLE:

Installation's gas heating (HTG) value: 1,000 BTU/ft<sup>3</sup>  
(Obtained from gas supplier)

Installation's seconds per cubic foot: 34 sec/ ft<sup>3</sup>

Conversion Factor (hours to seconds): 3600 sec/hr

Input = (Htg. value x 3600) ÷ seconds per cubic foot

Input = (1,000 BTU/ft<sup>3</sup> x 3600 sec/hr) ÷ 34 sec/ ft<sup>3</sup>

Input = 106,000 BTU/hr

This measured input must not be greater than the input indicated in Specification Sheet.

5. Repeat #1 through #3 on high stage (2nd stage).

6. Turn ON gas and relight appliances turned off in step 1. Ensure all the appliances are functioning properly and that all pilot burners are operating.

### TEMPERATURE RISE

Air temperature rise is the temperature difference between supply and return air. The proper amount of temperature rise is usually obtained when the unit is operated at the rated input with the "as shipped" blower speed. If the correct amount of temperature rise is not obtained, it may be necessary to change the blower speed.

An incorrect temperature rise can cause condensing in or overheating of the heat exchanger. Determine and adjust the temperature rise as follows. The temperature rise must be within the range specified on the rating plate or Specification sheet.

1. Operate furnace with burners firing approximately 15 minutes. Ensure all registers are open and all duct dampers are in their final (fully or partially open) position.
2. Place thermometers in the return and supply ducts as close to the furnace as possible. Thermometers must not be influenced by radiant heat by being able to "see" the heat exchanger.
3. Subtract the return air temperature from the supply air temperature to determine the air temperature rise. Allow adequate time for thermometer readings to stabilize.
4. Adjust temperature rise by adjusting the circulator blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise. Refer to the following section for speed

### CIRCULATOR BLOWER SPEEDS

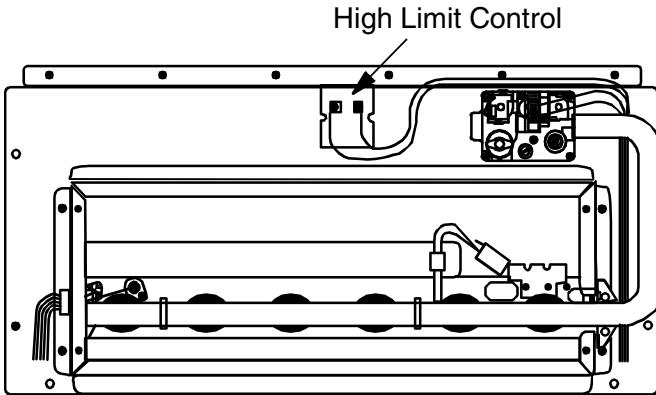


#### WARNING

To avoid death or personal injury due to electrical shock, turn off power to the furnace before changing speed taps.

All furnaces ship at high speed for cooling and the speeds listed in Specification Sheet for heating. These speeds should be adjusted by the installer to match the job requirements. See Specification Sheet for details.

Connect the correct motor leads to the COOL, HEAT LO, HEAT HI, and PARK terminals. If high heating speed will equal cooling speed, use the jumper wire provided. All unused motor leads that are not connected to "PARK" terminals on the control must be taped to prevent shorts.



**Figure 36**  
**High Limit Control**

#### **HIGH LIMIT CONTROL CHECK**



#### **WARNING**

**To prevent death, personal injury, property damage or premature failure of heat exchanger, do not adjust the limit control (factory preset).**

Check limit control operation after 15 minutes of operation by blocking the return air grille(s).

1. After several minutes the burners must go OFF. Air circulation blower will continue to run.
2. Remove air restrictions and burners will relight after a cool down period of a few minutes.

Adjust the thermostat setting below room temperature

1. Burners must go off.
2. Air circulation blower will continue to run a total of 60, 90, 120 or 180 seconds as set.

**IMPORTANT NOTE:** This unit must not be used as a construction heater during the finishing phases of construction of a new structure. This type of use may result in premature failure due to extremely low return air temperatures and exposure to corrosive or very dirty atmospheres.

#### **FURNACE SHUTDOWN**

1. Set the thermostat to lowest setting.
2. Turn off the electrical power supply to the furnace.
3. Turn the gas control knob clockwise  to the "Off" position (Figure 33). The knob should turn easily. Do not use excessive force.
4. Close manual gas shut-off valve external to the furnace.
5. Replace the door on the unit.

## **X. Maintenance**



#### **WARNING**

**To prevent death or personal injury due to electric shock, disconnect electrical power before performing any maintenance.**

#### **ANNUAL INSPECTION**

The furnace should be inspected by a qualified installer, or service agency at least once per year. This check should be performed at the beginning of the heating season. This will ensure that all furnace components are in proper working order and that the heating system functions appropriately. Pay particular attention to the following items. Repair or service as necessary.

Have vent pipe checked to be sure it is not blocked by debris which could permit fumes to enter the house. Replace any rusted or leaking sections of vent pipe.

**IMPORTANT NOTE:** Handle the igniter with care. Touching the igniter body with bare fingers, rough handling, or vibration could result in early igniter failure. Only a qualified servicer should ever handle the igniter.

#### **AIR FILTER**



#### **WARNING**

**To prevent death, personal injury or property damage due to fire, never operate furnace without a filter installed. Dust and lint will build up on internal parts resulting in loss of efficiency, equipment damage and possible fire.**

A return air filter is not supplied with this furnace; however, there must be a means of filtering all of the return air. The installer will supply filter(s) at the time of installation.

Filters should be inspected, cleaned or changed every two months or as required. It is the owner's personal responsibility to keep air filters clean. Remember - dirty filters are the most common cause of inadequate heating or cooling performance.



#### **WARNING**

**To prevent death, personal injury or property damage due to electrical shock, disconnect electrical power to furnace before removing filter or performing any other maintenance.**

Become familiar with filter location and procedures for removal, cleaning and replacing them. If help is needed, contact the installer of the furnace or a qualified servicer.

## AIR FILTER - UPFLOW FURNACES

To remove the external upflow filter from the external filter rack, disconnect electrical power to the furnace and follow the directions provided with the external filter rack kit.

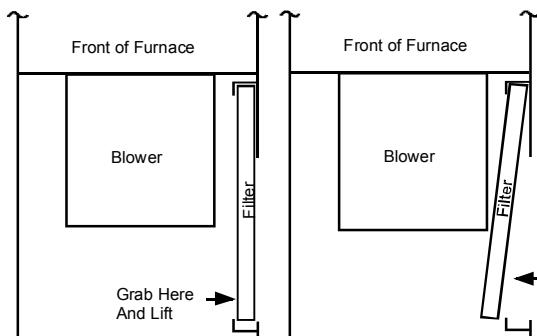
**NOTE:** If using Media Air Cleaner MAC1 or Electronic Air Cleaner EAC5, follow the directions that came with the air cleaner for proper filter removal, cleaning, and replacement procedures.

Replace the filter with the same type and size filter when needed.

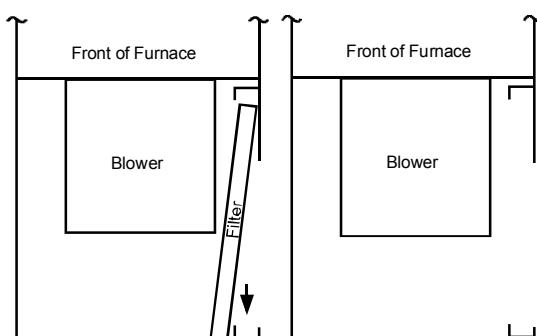
Remove the two front panels (louvered panel first). Using a vacuum cleaner, clean out the air circulation blower area, external filter rack or air cleaner area, and the adjacent area of the return air duct.

Clean, wash and dry a permanent filter. If using a media air cleaner (MAC1) or electronic air cleaner (EAC5), follow instructions provided with air cleaner for proper cleaning/replacement procedures. If using a metal filter, spray both sides with a dust adhesive as recommended on adhesive container. Spray adhesives for use with permanent metal filters can be found at most hardware stores. To reinstall filter follow installation instructions for the external filter rack or air cleaner. BE SURE AIRFLOW DIRECTION ARROW POINTS TOWARDS THE BLOWER.

When the filter is located in the bottom of the furnace on a bottom return system the filter is held in place by a wire filter retainer. To change and clean the filter, push back and up on the wire filter retainer to release it from under the front lip of the basepan. Slide the filter out and follow cleaning or replacement instructions above. Replace filter opposite of removal.



1. Lift filter above bottom rail.
2. Tilt filter to clear rail.



3. Lower filter below top rail.
4. Pull filter out.

## AIR FILTER - COUNTERFLOW FURNACES

A furnace mounted filter rack, shipped with the furnace, can be used in a counterflow installation.

The furnace-mounted filter rack includes a rack mounted on the top of the furnace. Two filters fit into the rack and rest against the sides of the return air plenum, forming a "V" above the furnace.

The filters should be inspected frequently and cleaned or replaced when necessary. If using a media air cleaner (MAC1) or electronic air cleaner (EAC5), follow instructions provided with air cleaner for cleaning/replacement procedures of filter. In some installations, the filters can be inspected after disconnecting the electrical power and removing the optional access door in the return air plenum. If this access panel is not present, proceed as follows:

1. Disconnect the electrical power.
2. Remove the non-louvered door from the furnace.
3. Remove the left filter by reaching to the left side of the blower, pushing the filter up slightly to remove it from the filter rack, and pulling it down to the left of the air circulation blower and out the air circulation blower door. Repeat with the right filter.

4a. Dirty throwaway filters must be replaced with the same filter type and size.

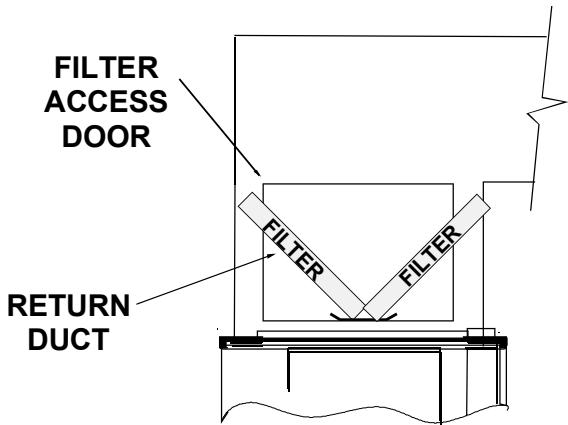
- 4b. Dirty permanent metal filters must be cleaned as follows:

Wash, rinse, and dry the permanent filters. Both sides should then be sprayed with a filter adhesive as is recommended on the adhesive container. Many hardware stores stock spray adhesives for use with permanent filters.

If badly torn or not able to be cleaned, these filters must be replaced by equal size permanent, high velocity filters. Throwaway filters must not be used as replacement for permanent filters. Under normal use, permanent filters should last for several years.

5. To reinstall the filters, first MAKE CERTAIN THE AIRFLOW DIRECTION ARROW POINTS TOWARDS THE FURNACE. Then insert the filters from the left side of the blower. Starting with the right filter, push the filter into the plenum so that the bottom of the filter rests in the filter rack and the upper edge rests against the side of the plenum. Repeat with the left filter (Figure 38).
6. Replace the air circulation blower door, then reconnect the electrical power.

**Figure 37**  
**Filter Removal**



**Figure 38**  
**Filter Rack Mounted On Counterflow Furnace Installation**

#### **AIR CIRCULATING BLOWER MOTOR**

The air circulating blower motor bearings are permanently lubricated. No further lubrication is required.

#### **INDUCED DRAFT BLOWER MOTOR**

The induced draft blower motor is permanently lubricated. No further lubrication is required.

#### **FLAME SENSOR (INTEGRATED IGNITION CONTROL) (QUALIFIED SERVICER ONLY)**

The fuel or combustion air supply can create a nearly invisible coating on the flame sensor. This coating acts as an insulator, causing a drop in the flame sensing signal. To remove this coating, a qualified servicer should carefully clean the flame sensor with emery cloth or steel wool. After cleaning, the microamp signal should be in the range listed in Specification Sheet.

#### **IGNITER (QUALIFIED SERVICER ONLY)**

If the igniter and the surrounding air are at about 70°F and the igniter wires are not connected to any other electrical components, the resistance of the igniter should not exceed 200 ohms. If it does, the igniter should be replaced.

#### **FLUE PASSAGES (QUALIFIED SERVICER ONLY)**

At the start of each heating season, inspect and if necessary, clean the furnace flue passages.

#### **CLEANING FLUE PASSAGES (QUALIFIED SERVICER ONLY)**

1. Shut off electric power and gas supply to the furnace.
2. Remove burner assembly by disconnecting the gas line and removing the manifold brackets from the partition panel.
3. Remove the flue from the induced draft blower and the collector box from the partition panel.
4. The primary heat exchanger tubes can be cleaned using a round wire brush attached to a length of high grade stainless steel cable, such as drain cleanout cable. Attach a variable speed reversible drill to the other end of the spring cable. Slowly rotate the cable with the drill and insert it into one of the primary heat

exchanger tubes. While reversing the drill, work the cable in and out several times to obtain sufficient cleaning. Use a large cable for the large tube, and then repeat the operation with a small cable for the smaller tube. Repeat for each tube.

5. When all heat exchanger tubes have been cleaned, replace the parts in the reverse order in which they were removed.
6. To reduce the chances of repeated fouling of the heat exchanger, perform the steps listed in Section IX, *Startup, Adjustments, and Checks*.

#### **BURNERS**



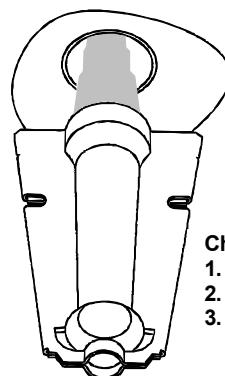
#### **WARNING**

**To prevent personal injury or death, do not remove any internal compartment covers or attempt any adjustment. Electrical components are contained in both compartments. Contact a qualified service agent at once if an abnormal flame appearance should develop.**

Periodically during the heating season make a visual check of the burner flames. Turn the furnace on at the thermostat. Wait a few minutes, since any dislodged dust will alter the normal flame appearance. Flames should be stable, quiet, soft and blue with slightly orange tips. They should not be yellow. They should extend directly outward from the burner ports without curling downward, floating or lifting off the ports.

#### **CLEANING OF BURNERS (QUALIFIED SERVICER ONLY)**

1. Shut off electric power and gas supply to the furnace.
2. Remove the burner box front cover.
3. Remove the burner retention bracket.
4. Remove the burners.
5. Use bottle brush to clean burner insert and inside of burner.
6. Replace burners and burner retention bracket, inspect the burner assembly for proper seating of burners in retention slots.
7. Reinstall the burner box front cover.



Check the burner flames for:  
 1. Good adjustment  
 2. Stable, soft and blue  
 3. Not curling, floating, or lifting off.

**Figure 39**  
**Burner Flame**

## **GENERAL INFORMATION**

1. When ordering any of the listed functional parts, be sure to provide the furnace model, manufacturing, and serial numbers with the order.
2. Although only functional parts are shown in the parts list, all sheet metal parts, doors, etc. may be ordered by description.
3. Parts are available from your Amana distributor

Gas Valve	Blower/Box Gasket
Gas Orifice, Natural	Flame Rollout Switch
Gas Orifice, Propane	Auxiliary Limit
Burner	Heat Exchanger
Igniter	Door Switch
Flame Sensor	Transformer
Gas Manifold	Blower Wheel
Ignition Control	Blower Housing
Limit Switch	Blower Cut-off
Pressure Switch	Blower Motor
Pressure Switch Hose	Motor Mount Bracket
Induced Draft Blower	Capacitor
Collector Box	